JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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EDITORIAL NOTES—GAS, &c.

Our "Daily Telegraph" Critic.

In other columns, we have submitted to criticism the reply of the "Engineering Correspondent" of the "Daily Tele-"graph" as published last week; and here we only call attention to one or two salient features. After inviting the industry's assailant to a discussion, we were duty bound to follow the matter up, though it has not been to us a very satisfactory thing to have to deal with such an exposure of an absence of knowledge on gas affairs by a critic of the industry as the article of last week made to all who read it, and who were competent as trained gas engineers and chemists to fairly pass judgment upon it. We hope the criticism and information in other columns will assure the "Engineering Correspondent" that, though, at the time he wrote his "Golden Lights" article, he had preconceived ideas on matters pertaining to the gas industry, behind them there was little that was substantial, but much that was vague and indefinable. We charge him in our article elsewhere with only having touched on one of several points comprising his original condemnation of gas in his efforts on behalf of electric lighting. The "Golden Lights" article has been printed and extensively circulated; its whole meaning and intention—the sentences have an incontrovertible meaning—are as patent as anything can be to any one qualified to judge. Having challenged our friend, or having questioned him on several points other than those upon which he has touched so ineffectively in the eyes of gas experts of scientific and practical standing, we are, notwithstanding our views as to his last week's performance, prepared to receive from him his defence and justification, on the same terms as before, of the other statements in his "Golden Lights" article which we have specified elsewhere; and we will then deal with them.

We ask this in the name of "fairplay." "Engineering "Correspondent" accuses us of a want of fairplay to him personally. We deny this. "Engineering Correspondent" takes upon himself the responsibility for the views expressed in articles which are endowed with his individuality by even the adoption of a *nom de plume*. But does the accusation of want of fairplay come with any particular grace from our friend? Consider the tenor of, and the positive statement in, the "Golden Lights" article. Did that show fairplay to the gas industry—circulated as it was broadcast through the columns of one of the most influential of our morning contemporaries? We do not think he has any right to raise the point as to fairplay. For our own part, we resign it absolutely to the discrimination of what he himself calls the "English spirit," and to the capacity for independent judgment of honest and intellectual minds.

Further, we are sorry "Engineering Correspondent" took up what must strike many as being a sort of superior attitude towards the gas industry, as reflected in his references to scientific training, and in his counsel to the industry. We confess that, during a long experience in technical journalism, we have never come across such an extraordinary position as has been divulged by this controversy, from the dogmatic assertion of the original article to the partial "defence" that itself is so frail that destructive criticism comes promptly. We have tried, with every desire to do justice to "Engineer-"ing Correspondent," to find how much of his reply in relation to gas affairs is based upon science; the result is one that we will not talk about.

What of the future? Will our critic now tell his readers of the "Daily Telegraph" that the gas industry and its affairs are not as he portrayed them on the points so far discussed; that the gas industry is doing business on legitimate lines in competition with electricity, and is making a highly gratifying financial result from it; and that his representations in October were not just to that industry? Will he also come out further, and answer our interrogations, and show us more of the substance of his defence on the other matters affecting the gas industry which we have picked from his original article? We are waiting for, and ready to deal with, them. Above all, it is hoped that we shall see the right thing done in the columns of our morning contemporary, which will be the clearest possible way for "Engineering Correspondent" to show that, in this matter, he is animated by that English spirit and by that fairplay which, we understand from the article in our columns last week, he so much admires. The gas industry, let it also be borne in mind, is not without the support of those qualities without which no industry can stand—science, practical ability, and commercial acumen.

We have to acknowledge the valuable contributions of correspondents to the controversy. These supply cogent facts supplementing and justifying our criticisms of "Engi-"neering Correspondent's" writings; and the letters bring back to mind various useful points that had escaped memory. If there are any other readers who desire to contribute to the evidence or criticism, our columns are not closed to them by the publication of the matter appearing this week. In his article in our columns last week, "Engineering Correspon-"dent" stated that he had been strongly advised by all independent men to whom he had spoken on the subject that he would merely waste his time by his explanation in our columns. We rather think those "independent men" will, after reading the material in our pages last and this week, claim that their advice was not ill-founded.

The Coming "Territorial" Gas Session.

The session of Parliament which we shall be facing early in the New Year promises to be for the gas industry an exceptional one territorially. Notices of Bills and Provisional Orders elsewhere in this issue indicate that expansion of area is the order of the day. But the projects for amalgamations in London's suburbs will together supply the *pièce de résistance*. We referred last week to the proposed fusion of the Bromley and Crays Gas Company and the West Kent Gas Company with the South Suburban Company. At the time the notices were given, it appears there was a little uncertainty as to the participation of the West Kent Company; but the negotiations had sufficiently advanced to justify making provision in the South Suburban notice for the transfer of the concern. The uncertainty that existed is further evidenced by the fact that the West Kent Company are themselves promoters of a Provisional Order to confer on them manufacturing powers over land adjacent to the River Thames at Erith. We observed last week that there was engineering and administrative foresight in the proposal to amalgamate these Companies, and that, in time to come, there were easily traced economies in it for a large gas-supply district, by works concentration at a place where gains could be effected in the transport of material. The suggestion in the proposed Provisional Order of the West Kent Company supplies an index to our meaning. Now this week, we have an equally imposing scheme for amalgamation. The Companies concerned in this are the Wandsworth and Putney, the Mitcham and Wimbledon, and the Epsom and Ewell. Precisely the same arguments apply to this project as to the South Suburban. By the amalgamation of these concerns, the gas supply of an extensive district will, in time, be subject to the advantages of water-carriage for their materials. When we consider the magnificent frontage that the Wandsworth and Putney Gas Company have on the River Thames, one can readily picture possibilities.

In the notices we can trace at least ten gas undertakings that are asking for power to push out their distribution systems into new territory; and there may be others that we have passed by in the meagre indications of the notices. Rearrangement of areas, too, is to be brought about by the purchase of small concerns. When the Bills are at hand, we can deal with this matter with greater positiveness. We see

that the Local Authorities of Ashbourne and Sidmouth are, under the purchase or suspensory clauses obtained this session, asking to be vested with authority for acquiring the gas concerns; and the Cannock District Council are, with a Purchase Bill, following closely up this year's Provisional Order of the local Company in connection with which the question of transfer was raised. The Chesham District Council have evidently decided not to take advantage of the purchase clause secured by them. The Bedwellty District Council, whose Bill disappeared this session, are again going to try to obtain possession of the New Tredegar Gas and Water Company and the Plackwood Gas Company; also part of the Rhymney and Aber Valleys Gas and Water Company, while selling to the last-named Company part of the New Tredegar Company's area. The East Hants Gas Company are proposing to undergo dissolution, and to rise again under the style of the Borden and District Gas Company.

Birmingham, Salford, Belfast, and Herne Bay are making, among others, preparations for the future by asking for new land and works' powers. As we were saying last week, the Salford Bill has given the outside districts an opportunity of re-introducing the question of the justice or iniquity of profit appropriation in aid of the rates of Salford, to which profit the outer areas under different administrations contribute. It looks as though the outside authorities—the Corporation of Eccles and the Swinton, Pendlebury, and Worsley District Councils—are going to compel the Salford Corporation to face the parliamentary music this session. They are doing this by a Bill of their own, which, so far as we can judge from the notice, is intended to confer upon Salford the powers they want as well as some they do not want. The latter include the abolition of district differential prices and the application of net surplus profits—not to the rates, but to the general reduction of the price of gas. The local authorities are not unmindful of the very remote contingency of the gas undertaking becoming a total loss; and they no doubt feel a considerable amount of safety in expressing their willingness to shoulder the obligation to contribute a share, according to the rateable value of the districts, of the moneys paid out of the rates of the borough in such an unlikely event as that referred to. The Arbroath Corporation have also a varied measure in preparation for promotion under the Private Legislation Procedure (Scotland) Act, 1899. Many of the promoters will be asking for additional capital powers, and the modern testing and other clauses. There is the Joint Standard Burner Bill, with its fifteen Companies as the promoters, which number shows that many gas undertakings have allowed a good opportunity to slip past them. The Bognor Gas Company, and probably others, will be asking for electricity powers. There is also the joint promotion of seven companies in relation to benefit funds, the reason for which is not at present altogether clear. Looking round generally, the number of gas promotions for the session may not be great; but there is a distinct improvement in quality and interest.

Science and Co-Operation in the Gas Industries.

In a very practical way, the Society of British Gas Industries—the members of which are not only men of commerce, but experts in their particular walks in the gas industry—testified, at their autumn meeting last Thursday, to their appreciation of the fact, through a resolution to make a generous contribution to the British Commercial Gas Association for three years, that, as their President (Professor Arthur Smithells, F.R.S.) puts it, there are larger interests that must take precedence, in an industry such as ours, of pure commercial rivalry among themselves. In a second way, they again show their appreciation of the singleness of the objective of the gas-supply industry and the apparatus manufacturing industries by inviting, and securing the consent of, Mr. Corbet Woodall to become the successor of Professor Arthur Smithells in their Presidential Chair, and thus continuing the line of distinguished Presidents. In this way, it is hoped that the jubilee year of the Institution of Gas Engineers will see Mr. Corbet Woodall presiding over the whole of the constituent parts of the industry. This being the happy case, the jubilee year of the Institution—as the chief central organization of the gas industry might be further marked—by making an exception of the year, and issuing personal invitations to at any rate the Council, if not the whole of the members, of the Society of British Gas Industries (they are all principals in the firms they represent), to be present at the annual meeting of the Institution. Further to that year, there is the great gas exhibition it is proposed to hold, and in working for the success of which it is hoped there will be the heartiest co-operation between the Institution and the Society. The year will therefore be one in which the scientific progress of gas utilization will be accentuated in a manner that should make the doings of the year exceptional, and therefore fully justify the suggestion made here.

The spirit of co-operation and the recognition of the application of science—science interpreted in no narrow academical sense—to production and business generally ran through the whole meeting of the Society, mainly owing to the paper that Mr. H. James Yates contributed to the proceedings on the two subjects which he blended together by many philosophic thoughts. These were of a nature over which there could not be much controversy, as any dissent from them would simply label the dissenter as living in the darker times of the past. The plea of the author of the paper was for hearty co-operation not only in the large and practical affairs of the life of the industry to which reference has already been made, but within the walls of the manufacturing works. The manner of co-operation there towards making for industrial success is by producing the very best—a progressive best—by the aid of science, system, and modern method. That is true co-operation in an industry the vital parts of whose existence are found in the economy and efficiency of that which it has to offer. There may be a few unregenerates in the industry, a few who hold back and still tread the paths of tradition; but on the whole the last few years have shown the progressive spirit on all hands and the various sections of the industry have disclosed, as it was never disclosed in the days of old ways, a homogeneity, the requisities for making a compact whole, and the indispensability of one part to the other.

The old doctrine "every man for himself" does not apply without qualification in an industry such as that in which we are all concerned. Commercially, it partially holds true. Trade competition is good for all; but if we ponder over those "larger interests" to which Professor Smithells referred, it is not difficult to see how every man serves his own ends best by serving the gas industry in the way that will, in the most rapid and permanent manner, advance its interests. Just as in every forward movement of those interests all must share, so in every recession must all participate. In this we see the indispensability one to the other of every section of the industry, the essentiality of co-operation, and the application of science in its every phase. In the matter of indispensability and mutuality of interest, there is no need to discriminate as to which section is in the present pre-eminently important. Mr. Yates says: "It is "to the makers of gas apparatus and more particularly in "the spheres of lighting, fuel, and power, that the gas in-"dustry must *chiefly* look for those successful forward move-"ments that must continue to be made in order to main-"tain the position against the keen competition of more "than one trained industry." The lighting, the fuel, and the power apparatus makers could not drive the industry forward without a cheap gaseous fuel of good and suitable thermal value; and to the production of such fuel, the gas-works' plant makers and gas engineers and managers all contribute by their labours. We cannot do without the scientifically controlled, co-operative efforts of any section. The industry is an indivisible one; and to individualize the importance of one over the other in the cause of future progress is not necessary to-day. We are now preaching co-operation, and saying that the relations between the gas-supply section of the industry and the gas apparatus makers "have hitherto been too exclusively commercial for the best "interests of the industry itself." That is being remedied. The forces at work will not allow any stubborn resistance on the part of an effete and mistaken attitude. In this respect matters are well on the right high road. Those who will not recognize and practise the things of which Mr. Yates speaks (which are by no means new, but worthy of insistence so long as there are the unconverted to be converted) are those who will be left behind in the modern race. For them there can be no sympathy.

References were made at the meeting to the enterprise of the gas industry in establishing the Livesey Chair at the Leeds University; but it seems that the sons of the gas industry have not as yet fully grasped the opportunities offered to them there. Professor Smithells, however, is not by any means despondent. His long University experience has taught him that such enterprise grows but slowly. The

scheme is new to the gas industry. Its men have been in the habit of acquiring their knowledge in different manner and by different route. But when we have regard to the trend of thought in the industry in such matters as the co-operation of science, the higher forms of gaining knowledge must, we think with Professor Smithells, eventually prevail. Meanwhile what has the Livesey Advisory Committee to say on this subject?

A Scandalous Electrical Advertisement.

The British Commercial Gas Association has commenced its first protective work of the interests of the gas industry; and the occasion is one that imperatively demanded the prompt intervention of this body, though its working machinery has not yet been fully organized. But no absolution will be required for moving expeditiously and effectively on an occasion such as this. In the midst of the Smoke Abatement Exhibition at Manchester, where there were both gas and electrical exhibits, an advertisement was published, in the electrical interests, under the cover of anonymity, in the "Manchester Guardian;" and in the advertisement gas was defamed in the most vituperative and sinister fashion. The general tenor of the advertisement will be gathered from the opening paragraphs of our "Electric Supply Memoranda." It is not surprising that no indication appeared as to the authorship of, or as to the parties responsible for, the advertisement. It was a cowardly, underhanded attack; and those who are temporarily responsible for the British Commercial Gas Association did the right and proper thing in taking immediate counteractive steps by putting advertisements in the "Manchester Guardian" on three consecutive days last week, dealing with some of the more important features of the attack, and so, it is hoped, defeating some of the mischief intended to the gas industry.

There are a few words to say to the Manchester Corporation Gas Committee. It is a duty they owe to themselves and to the gas industry at large to endeavour to trace the authorship of the advertisement in question. We have no notion as to the responsible parties. It was quite easy for anyone, quite outside the Corporation Electricity Department, to make it part of the business of the advertisement to direct inquiries regarding electricity to be made at the Department; but the fact that this was done is sufficient ground for the Gas Committee to take steps to assure themselves that this grossly libellous advertisement did not emanate from the Electricity Department, or was not in any way instigated by any person in the department. We hope they will cause investigation to be made into this matter, even if they have to bring the question before the Council to ensure this being done. It is time that such slanderous misrepresentation was put down with a very firm hand by the gas industry. Already we know of more than one gas company who have compelled electric concerns to withdraw misrepresentation, and who were prepared, as an alternative, to carry the matter to the Law Courts. We yet hope to see an electricity supply company or municipal supply authority brought right into Court, without the option of withdrawal, and their officials put under examination in the witness box. We ourselves not long since had to compel the withdrawal of a mischievous statement wrongfully attributed to us in an electrical quarter, and should have carried the matter further than correspondence had not this effected the purpose. But reverting to the advertisement now before us, there must surely be men in the electricity industry who cannot be proud of this throwing of mud from behind the barrier of anonymity, as being fair commercial tactics. No gas concern knows when it will be attacked in the same cowardly fashion; and those undertakings that are subscribers to the British Commercial Gas Association will be certain in such an event of good support and advice from that quarter.

Publicity and the Society of British Gas Industries.

There has been a little doubt as to the total sum that the British Commercial Gas Association would be receiving as a contribution from the Society of British Gas Industries. But approximately it has now been settled. At the last Publicity Conference at the Institution of Mechanical Engineers, the Chairman of the Society (Mr. H. James Yates) made, in consultation with his Council, the forecast that the possible contribution of the Society would amount to £1500; but at the meeting of the members of the Society last Thursday, a resolution was passed that £2000 should be raised. This is an advance on the first prediction; and when all the members of the various sections have announced their intentions, we should not be surprised to find that the total contribution will exceed the £2000. Anyway, this good round sum is now a certainty. The Society are showing themselves a power in the industry, and a power that believes in co-operation, and in the old but true adage "Unity is Strength."

Co-Partnership in the University.

The pioneers of co-partnership in the gas industry have carried and enunciated their principles in many places; but, we believe for the first time, the gospel of co-partnership has now been preached in one of the colleges of one of our great Universities. On the eve of the half-yearly meeting of the Labour Co-partnership Association at Oxford last week, Mr. Charles Carpenter opened a discussion on the subject before a gathering at Baliol College; and the trend of the address is given in our news columns. His arguments are clearly set forth; and from them, it will be seen there are two main points he particularly emphasized which must, in these turbulent times in the sphere of labour, appeal to all students of social and economic problems. It is obvious that there is greater unrest to-day in the labour world, and greater effects arising from this unrest, than ever before; and that, generally speaking, in many industries, the men are not working so well as they were formerly. The causes of these things are traceable. There is a common feeling among the workers that they are not sharing in the right proportion in the increased and increasing prosperity of the country; while, on every hand, the cost of existence is pressing heavier on them, partially (this is often overlooked) through the mistaken efforts of those who subscribe themselves as the workers' best friends and guardians. The grievance, stimulated by demagogic utterances and advice, results in the poorer work of the men. The remedy is co-partnership. It has been found in the gas industry to kill the very roots of discontent, and to raise in its place a crop of activity and goodwill that makes the partnership of employers and employed very real. This was the essence of the message, drawn from twenty-two years' experience, that Mr. Carpenter had to deliver in Baliol College last Friday evening.

Gas Profits and the Rates.

There were some strong opinions expressed, in the course of the proceedings at last week's Smoke Abatement Conference in Manchester, on the subject of the making of gas profits for the purpose of subsequently handing them over in relief of the rates. Those who are actively engaged in endeavouring to get rid of the "smoke nuisance" are fully alive to the necessity, if their aim is to be accomplished, for gas to be supplied at the lowest possible price; and it cannot be said that it is being supplied at the lowest possible price when a substantial surplus has to be realized for the benefit of the general rates. The Secretary of the League ventured upon the assertion that, if the Manchester Corporation would forego the profit of £50,000 a year which they now make on the gas undertaking, they would be going far towards doing away with the loss of at least £700,000 a year caused by smoke. This is a point that is well worthy of consideration by the advocates of "profits for the rates." Again, it does seem unfair, as was remarked by the reader of one of the papers, that, by this practice of handing over profits in relief of the rates, the incidence of taxation should be so altered that the householder who fits up his premises with gas heating and cooking appliances, and thus assists to keep the atmosphere pure, is compelled to pay more in rates, while his neighbour, by continuing to burn coal, and helping to poison the atmosphere, pays less than he would otherwise have to do. A delegate did, it is true, bring forward the familiar argument that a ratepayer has a right to a proportion of the earnings of a municipal gas undertaking, inasmuch as it was on his credit as a ratepayer that the capital for the concern was borrowed; so that he had a claim to come in as a shareholder. But this view did not seemingly commend itself to other speakers—at any rate, so far as refers to such sound business propositions of general utility as gas undertakings. It will be noted from the report of the conference which appears in our news columns, that Bailie Smith, of Glasgow (where gas profits are not handed over in relief of the rates), said he had found that, taking them all the year round, gas-fires for domestic use were not more than 10 per cent. dearer than coal-fires; and this without making any allowance for the

extra labour involved in the use of coal. Mr. Peter Fyfe, the Chief Health Inspector of the same city, also supplied figures showing that with a gas-fire and electric fan he could heat a room for seven hours (consuming 37 cubic feet of gas per hour) at a total cost of 6¾d.; whereas he calculated the cost of coal at 6d. This is reckoning the cost of the gas consumed (at the Glasgow price) at 6d., and that of the electric fan at ¾d.

Gas Workers and National Insurance.

The Government have had a hard nut to crack in the matter of the appeal of the South Metropolitan Gas Company's men to be allowed to contract-out of the National Insurance Bill, in view of the fact that they are at any time in a position to satisfy the Insurance Commissioners that the terms of their employment are such as to secure provision, in respect of sickness or disablement, not less favourable, but more favourable, than the benefits provided for under the National Insurance Bill. The attempt by the Government to crack the nut was unsuccessfully made when the matter was again before the House yesterday week, for every argument that was put forward by the sympathizers—Sir Henry Kimber and others—with the men's desire to contract-out was of a strength that made the arguments against (as advanced by the Government) appear extremely feeble. The Government simply fenced with the arguments put forward with such frail weapons as that they must have absolute security, and that the national scheme was superior to the private ones. The men's parliamentary sympathizers pointed to the unimpeachable security offered by the Company, and to the willingness of the Company to bring their own scheme into absolute line with the national measure. As a matter of fact, as the Chairman of the Company (Mr. Charles Carpenter) has shown, they can, with their present rates of contribution, give higher benefit than the measure proposes, and higher still if contributions were raised to the lines indicated by the Bill. There was nothing the Government advanced that could not be met. But the fight for freedom did not succeed. The Government will not allow Gas Companies to contract-out though they can satisfy the Insurance Commissioners in the manner indicated. The Bill is giving exemption to municipal authorities, and to those who are employed as clerks or in other similar capacity in the service of railway and other companies; but the workers who would rather be left as they are, are treated differently. Really, we cannot understand why there should be differentiation either in class, or between municipal and company gas undertakings. But there are many things that ordinary mortals cannot understand about the national insurance scheme. Perhaps the House of Lords would lend a more favourable ear to the aggrieved gas workers.

Municipal Trading and Company Shareholders.

A writer in one of the local papers, dealing with municipal affairs at Hastings, has "hit the nail on the head" in a manner which is not always witnessed when newspapers deal with municipal affairs. The subject of his two articles is the Corporation electricity undertaking and the position of the Gas Company; and what he has to say is well worth the attention of those to whom it applies. That which gave rise to the reflections was an unfounded report circulated during a municipal election that one of the candidates was a shareholder in the Gas Company. Dealing with the argument of the Progressive leaders, that the interests of the ratepayers of Hastings and the interests of those who have invested in local companies are not identical, it is pointed out that the history of the Gas Company is an honourable one, that the concern is capably managed, and that it is a sound, honest industry. "When," asks the writer, "in the whole course of the history of the Gas Company, has any director or shareholder used his interest, when acting on the local authority, to the disadvantage of the ratepayers? Though without break gas directors and shareholders have sat on the Council, what special concession or consideration has at any time been given to the Gas Company that would not be given to other business concern?" These questions apply equally to other places as to Hastings; and the protest against regarding gas shareholders with suspicion in relation to council work, because they happen to have placed their money in a local undertaking, is one that may be welcomed. It is true that Hastings is burdened with an unprofitable municipal electric undertaking; but, as is pointed out, all the gas investor asks is that its competition should be fair. In other words, it should be on a business basis—which is not invariably the case at present. This is how the writer of the article sums the matter up: "The non-investor demands preferential treatment for municipal undertakings; the investor demands that if the Corporation are in trade they shall conduct the trade on fair business lines. The non-investor would bring to bear on the accounts all the little tricks by which municipal undertakings are able to declare a profit when there has been nothing but loss; the investor demands that municipal undertakings shall be run on ordinary business lines, so that the ratepayers are not deluded into believing they are reaping a golden harvest when all the time there is loss—and loss not only on the actual enterprise, but also to the town by reason of unfair and unscrupulous competition with private concerns." It is rate-aided competition and preferential treatment that are objected to by those who have a stake in local enterprises; and in the case of the Hastings electricity undertaking, it has been made evident that there is much which can be taken exception to.

Municipal Gas Supply in Singapore.

In another part of the "JOURNAL" will be found some particulars from the report of the Gas Engineer of the Municipality of Singapore (Mr. J. P. Hallaway) for the year ended Dec. 31, 1910. It bears evidence of good work during the period covered, and of excellent progress since the undertaking was acquired by the Municipality in 1901. In the first year of their management, the make of gas was rather more than 44½ million cubic feet, of which private consumers took about 13¼ millions, and the price was $3·80 per 1000 cubic feet. Next year, while the make increased 2·4 per cent., the sale for private consumption went up no less than 32 per cent. In the interval to the beginning of the year dealt with in the report, the price had been reduced to $3, with lower prices for large monthly quantities. In July, 1910, a reduction was made which was followed by increased consumption among the small consumers, to the displacement of oil. Mr. Hallaway is confident a further concession, which, it appears, the finances of the undertaking justify the Municipality in making, would not only be attended by greatly increased sales, but would strengthen their position against competitors. In 1909, the gross profit was $84,959, with a net profit of $26,497; last year, however, the gross profit was $129,482, with a carry-forward of $44,558. With regard to working, Mr. Hallaway makes 12,608 cubic feet and sells 12,150 cubic feet of gas per ton of coal; the unaccounted-for gas last year being only 3·6 per cent. of the quantity sent out. Altogether, he has much reason for satisfaction at the results of the year's working.

Black Marks.

Not long since we recorded a case in London where several persons were rescued from suffocation due to the fumes arising from the fusion of a street electric cable. People in the Strand on Thursday afternoon last had an illustration of the powerful effects of such a fusion; and some seven persons were transferred to the Charing Cross Hospital, carrying with them marks of the violence of an explosion that occurred. Fortunately, only one had to be detained. The first indication of the fusion (the official report states that about 15 feet of cable was involved) was a thin stream of smoke from the pavement, then followed the explosion, and the injury to persons, private property, and pavement. The proprietor of one shop says that, on his premises becoming full of smoke, he saw flames round his electric switchboard. "He turned off the switches; and, in doing so, received a shock, the force of which was terrific." It was an unpleasant experience; and the gentleman concerned at all events will not in future look upon electricity as quite so innocent and harmless as its vendors represent it to be. Nottingham has had a similar experience. A smell of burning bitumen, and smoke issuing from the pavements were the preludes to the partial wrecking of the Albert Hotel by explosion in the early hours of Sunday morning, and injury to ten persons, seven of whom were, at the time of the receipt of the latest news, still detained at the General Hospital There was no doubt about the fusing of the electric cable which runs between the arches of the hotel cellar and the street pavement; and Mr. Councillor A. Ball, the Chairman of the Gas Committee, states that careful tests of the gas-pipes were made on Sunday, and they were all found intact. Locally the affair is looked upon as a mystery. Another incident. West Ham experienced a failure of the electric supply just before 9.30 on a

recent Tuesday evening. The event is reported in the "West Ham Express" for the 22nd inst. The streets, private houses, and public buildings where electricity has been installed were all, without the slightest warning, deprived of illumination. Serious inconvenience was experienced by the sudden darkness in places of entertainment. In the interests of public safety, all such places, where electricity is used for illumination, ought to have an alternative system of lighting for such emergencies. It is stated that the current was only off for about fifteen minutes, but time enough, had there been any alarmists about, to do untold mischief. The accident that caused the cessation of supply occurred at the generating station; and there the staff, it is said, had a somewhat startling experience.

Nottingham Appointment Filled.

We learn from our local correspondent that, out of upwards of ninety applicants for the position of Engineer and General Manager of the Nottingham Corporation Gas Department, in succession to Mr. J. H. Brown, the Gas Committee have appointed Mr. John Wilkinson, F.C.S., of Halifax, at a salary of £1000 per annum. Before the final selection was made, the Committee had interviews with Mr. Harold Copp, of West Bromwich, and Mr. W. J. Smith, of Bolton. Mr. Wilkinson went from Sheffield, where he was Manager of the Grimesthorpe works of the Sheffield Gas Company, to Halifax in 1903, in succession to Mr. Thomas Holgate. Before obtaining the Sheffield appointment, he was Engineer and Secretary of the Drighlington and Gildersome Gas Company; and he had been previously Assistant Manager at Pudsey. He was for a time Honorary Secretary of the Manchester District Institution of Gas Engineers—being chosen for the position on the retirement of Mr. S. S. Mellor. He will enter upon his duties at Nottingham at an early date.

Messrs. Ashmore, Benson, Pease, and Co.

Readers will be aware that Messrs. Ashmore, Benson, Pease, and Co., Limited, by their patent No. 4613 of 1910, introduced a new type of washer-scrubber, in which they use a special form of non-metallic and non-corrosive filling. The apparatus also has external and adjustable liquor overflows; while the filling material, being of an absorbing nature, takes up a considerable amount of moisture, and by its arrangement in the scrubbers divides up the gas very minutely. These advantages should make the apparatus of special interest to gas engineers, in view of past experience with washers using metallic filling, which is subject to corrosion and the possibility of accidents in cleaning. The filling used by the patentees in their new form of washer-scrubber is protected by the action of the gas and liquor, and is rendered practically indestructible. These washer-scrubbers have been in use for some time now, and have given, we understand, complete satisfaction. They can be seen working on application to the patentees, who would be pleased to give every information. The firm have also patented an improved rapid automatic fastener for luteless purifiers, on the cam and lever principle, which they claim has many advantages over any other type at present in use. These fasteners are particularly suited for purifiers erected in the open, as there are no parts that could possibly be affected by the weather. The range of adjustment is very large, thus ensuring perfectly tight joints. Messrs. Ashmore, Benson, Pease, and Co. have also taken up the manufacture of Pickering's patent valves for purifiers, which have been adopted at over sixty gas-works. These valves obviate the necessity for connections such as are required with certain types of centre-valves; and as the valves bolt directly on to the purifier plates, no floor-space whatever is occupied, and no foundations are needed. Especially are the valves useful in elevated boxes, and wherever space is of value. All working parts are easily accessible from the outside. The faces of the valves being vertical, the possibility of leaks from dirt deposit is reduced to a minimum. The valves have recently been adopted at Margate, Coalville, Burnhope, and Workington; and it should be noted that any number of purifiers can be worked with the type of valve referred to.

Diamonds from Coal Gas.—An announcement, received through Reuter's Agency from Berlin, appeared in the daily papers last week to the effect that Dr. Werner von Bolton, a chemist at the works of Messrs. Siemens and Halske, had discovered a new process for the manufacture of artificial diamonds, according to which coal gas was acted upon by mercury vapour from sodium amalgam, and carbon was thereby liberated from the gas, partly in the amorphous state, but partly in the crystalline state as diamond. That liberated in the latter condition was so minute in size that a small quantity of diamond dust was introduced into the tube containing the sodium amalgam in order to provide nuclei on which larger crystals might be built up. In this way some stones, still quite small, but larger than the former minute particles, were obtained. The coal gas was passed through the glass tube for four weeks. Further increase in the size of the stones is now said to be engaging the attention of the inventor.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 632.)

THE week just closed on the Stock Exchange was dull almost to the point of lethargy. For this one had to accuse a variety of factors. The rather strained position of Anglo-German relations, in regard to which Sir E. Grey's speech is eagerly awaited, the Commons' debate on the great Labour question, apprehensions of dear money, and the long nineteen-day account, all conspired to repress enterprise. Movements—where any were—were mostly irregular, and prices on the whole were lower. The opening was dull and languid; and most markets were weaker. Rails rose and fell through the day, finally closing lower. Americans were down; and the Foreign Market was lifeless. But Government issues found support, and Consols rose $\frac{1}{16}$. On Tuesday, things were torpid again, but began to brighten a bit at the close. Rails were inactive and sensitive to small sales. Americans swayed about; and the rest were very quiet. Wednesday was altogether inert. Consols did not move. Rails fell a little, and then recovered a little. Americans were moderately better. On Thursday, business was quieter than ever, if that were possible; but there was no pronounced weakness. Consols were $\frac{1}{16}$ lower; but Rails took a more cheerful view of the labour troubles. The Foreign Market took no heed of international questions. On Friday, the tendency was generally downward on realizations. The gilt-edged class were dull, and Consols fell $\frac{1}{8}$. Rails lost their cheerfulness and receded. Americans were about the firmest market. Saturday was normally inactive; but markets were mostly pretty steady, except Americans. Consols recovered $\frac{1}{8}$, and closed at $78\frac{1}{4}$-$\frac{1}{2}$, showing no variations on the week. In the Money Market, rates steadily hardened until near the close, when the strain was relaxed. Business in the Gas Market was on about the same scale as the week before; and the tone was just as firm. Projected amalgamation furnished an interesting topic. Following on recent absorptions of West Ham, Barking, and Chigwell on the north side of the Thames, now comes the turn of the south side. Towards the west, the Wandsworth and Putney Company proposes to amalgamate the Mitcham, Wimbledon, and Epsom Gas Companies; and, in the east, the South Suburban proposes to amalgamate Bromley and West Kent. Upon the latter project becoming known, Bromley stocks rose freely. In Gaslight and Coke issues, the ordinary was steadily dealt in at unchanged figures—$104\frac{1}{4}$ to 105. In the secured issues, the maximum made $85\frac{1}{2}$ and $86\frac{1}{4}$, the preference $103\frac{1}{4}$ and 104, and the debenture $81\frac{1}{4}$. South Metropolitan was steady at from 116 to 117; and the debenture marked 80. In Commercials, the 4 per cent. realized from $110\frac{1}{2}$ to $111\frac{1}{2}$, the $3\frac{1}{2}$ per cent. $105\frac{1}{4}$, and the debenture 76. Among the Suburban and Provincial group, British made from 45 to $45\frac{1}{4}$, Bromley "A" 128 and 131, ditto "B" 98, Brentford preference 120 and $121\frac{1}{2}$, Lea Bridge $128\frac{1}{4}$, and (on the local Exchange) Liverpool "A" 220, and Chester 111 and $111\frac{1}{2}$. In the Continental companies, Imperial was done at from 184 to 185, and European at 20 and $20\frac{1}{4}$. Among the undertakings of the remoter world, Bombay changed hands at $6\frac{15}{16}$ to $6\frac{17}{32}$, Buenos Ayres debenture at $95\frac{3}{4}$, Cape Town preference at 5 and $5\frac{1}{8}$, Monte Video at 12, Primitiva at $7\frac{5}{16}$ to $7\frac{9}{16}$, ditto preference at $5\frac{1}{8}$ to $5\frac{7}{16}$, River Plate debenture at 96 and $96\frac{3}{4}$, and San Paulo at $10\frac{5}{16}$ and $10\frac{15}{16}$.

ELECTRICITY SUPPLY MEMORANDA.

Quack Advertisements—An Example from Manchester—The Exhibition that Failed with the Public—Cooking Tariffs—Thermal Storage - Carbon Filament Lamps as Heaters.

THE advertisements of the quack have a pronounced individuality, and to the refined mind a distinctly nasty flavour. Their preparation is an old art; and every generation produces fresh practitioners of the art. In their distress at the difficulties presented to them by the still growing efficiency of the appliances of the gas industry and the commercial activity of the latter, the electrical industry has thought fit to fall back upon the practices of the advertising charlatan. The drafting of their advertisements shows splendid imagination for the low charactered work; but having recourse to this sort of advertising shows lack of intelligence and prudence. The public recognizes the advertisements of the quack; the public knows, too, that these advertisements are meant to catch the people of small mental capacity. People to whom such advertisements appeal are not usually those with financial means such as the electrical people are anxious to get hold of. Therefore, adopting the style of the quack in advertising may do more harm than good to the electrical industry. People with brains and experience are not trapped by such distortion as appears, for instance, in an advertisement in a recent issue of the "Manchester Guardian," headed, "The Winter of Discontent." We do not know to whom the credit belongs for framing this advertisement—whether the Manchester Corporation Electricity Department, the Electricity Publicity Committee, or whom. Information as to authorship, whoever is responsible, ought to be published, so that the honour of possessing, to a high degree, the facility of framing advertisements of the quack order may be bestowed on the persons responsible. The advertisement directs people to make inquiry at the Town Hall, Manchester. May the question be asked without offence whether this advertisement was, in any way, influenced by the Corporation Electricity Department?

If it was not, then the Department ought surely to take steps to eliminate from the public mind any suspicions on this score that may have been aroused by it.

"The Winter of Discontent!" It seems to be one long winter of discontent to the electricity supply industry; and there will be no emerging from it by the aid of the paltriness found in this advertisement. Such extravagant statements as appear in it suggest to people with brains that they will be wise not to take electricians at their own valuation. It will suffice to call attention to some of the choice points and phrases of the advertisement, without making particular comment upon them. The advertisement leads off by depreciating the smoke abatement movement by alluding to the "small talk" about it; and then an amount of "small talk" is indulged in with reference to gas and electricity that will induce the smoke abolitionists to measure the slight by the performance of those who tendered it. We meet an early reference to the "gas cooker that cooks toast to a cinder." A reminder of the ancient adage that there can be no smoke without fire brings us to this: "Whatever sort of fire it is, it adds pollution to the atmosphere . . . . it may be invisible lethal vapour as from a gas-stove." The word "lethal," we observe, appears three times in the course of the advertisement. It is consequently deliberately intended that the weak-minded among the public shall be duly frightened. Of course, this "unnecessary danger to human health" can be absolutely prevented by lighting "without heat," and by heating "without fire." That is to say the selective properties of electricity enable it to withhold heat when it is used for lighting, and to shed heat when employed for heating and cooking. It is very wonderful. A few lines further on we see "electric cookery is actually further ahead of gas cookery than electric lighting is of gas lighting. Electric light is cheaper than gas, brighter than gas, cleaner, simpler, and more convenient than gas. The gas-fired oven "roasts the juice out of meat;" and—

In a gas-oven you have no radiated heat, and most of such heat as you do get goes up the flue, and its place is taken by cold air from underneath, which in turn has to be heated at a great expense to you. If the gas-cooker man argues that his hot, foul gases don't go up the flue he must admit that they stay behind and contaminate the meat. If they don't contaminate the meat, they must carry heat up the chimney. Which is it? As a matter of fact, it is both. At least half the heat of combustion goes up the flue, and some of the meat goes with it.

Following this, we read: "It can be proved beyond all doubt that cooking by electricity at Manchester rates is as cheap as cooking by gas at Manchester rates, when judged by the amount of food that can be put into the range to cook for one penny. Judged by the amount of food, and the quality of the food, when taken out of the oven, it is cheaper." With electricity, the cook is "never late with the breakfast because she has lost her matches, because the sticks are damp, or because the burners *will* light-back." Other misrepresentations will be found in the following sentences: "The sun doesn't send lethal vapours to impair your vitality. A gas-fire does. It begins with a headache. One gas-burner in a room destroys as much life-giving air as five people. And yet the one-idea-ridden advocates of gas actually recommend it for bedrooms. Bedrooms!" Yes bedrooms!! We should like to have the author of this beautiful effusion under examination on oath. We rather think he would cut a poor figure both as to knowledge of what he is writing about and as to veracity. One final idiotic statement: "Electricity can demolish the case for coal and gas—tear the flimsy mantle from its back." This appears to be a piece of bad construction. However, it really all comes to this, that electricians have concluded that it is necessary for them to descend to this quack style of advertising in putting forward the claims of electricity. What a pity for electricity that electricity needs it!

The cloud of discontent that exists in the electrical industry over the recent Electrical Exhibition at Olympia is hardly likely to be dispersed by the defence of their actions that the Organizing Managers have made to the Executive Committee; for if the report means anything at all, it is that the Organizing Managers fail to see what more could have been done than was done to attract the public. Therefore, it may be deduced from this that the whole cause of the failure was that the public doggedly refused to be drawn to Olympia. Of course, if the public will be obstinate, nothing can move it—notwithstanding the vain boast of an electrical paper while the exhibition was running that an electrical exhibition had only to be opened, and the public would be there. The public, in fact, could not resist. It did this time, though the defenders of the organization state that the exhibition was advertised on every railway system throughout the United Kingdom; and there was probably not a single railway station in the London area on which posters were not displayed for a fortnight prior to, and during the whole run of, the exhibition. A few hundred bills were also displayed on carriers' vans. Yet the public was irresponsive. The Organizing Managers do not find any important practical suggestion that has been made since the exhibition that was not anticipated by them. However, experience is an excellent teacher; and the gas industry at the time of their next large show may take advantage of some of the suggestions now made. In brief, these are that half-crown days be abolished; that exhibitors be supplied with tickets in unlimited quantities, with the liability that all such tickets as reach the management through the turnstiles of the exhibition shall be paid for at the rate of 6d each; that the duration of the exhibition be restricted to three, or conceivably two, weeks only; that before another electrical exhibition is decided upon, some definite arrangements should be made with the supply authorities to ascertain exactly the amount of support by way of purchase of tickets they are willing to accord—it being recommended that, for a large exhibition such as that recently held, this purchase of tickets should be not less than 150,000 to 200,000. It is further recommended that the arrangements with the supply authorities should be for the sale to them of tickets outright at 3d. each. The Organizing Managers think that if arrangements were made with the supply authorities to pay for all tickets used at the rate of 6d. each, it is most probable that this would considerably curtail a large distribution of tickets, and this "for obvious reasons." We will not ask what is meant by the three last quoted words; but some supply authorities may think that it is a nasty and uncalled-for smack.

The canvassers of the Marylebone Electricity Supply Department must surely require a handbook to support them under the load of different tariffs that are open to those among the ratepayers of Marylebone who desire to become electricity consumers. In view of Mr. Seabrook's abounding faith in electric cooking, he desires to introduce a further complication in the tariffs by attempting to encourage—apparently they want much encouraging—the consumers on the "telephone" system to commit themselves and their families and their purses to electric cooking. The telephone system is a lump sum down, with payments afterwards of 1d. per unit of electricity consumed. What is proposed is that during the six summer months—April to September inclusive—current used for cooking is to receive a discount of 25 per cent. Of course this does not mean that the average price paid for electricity for cooking during the summer months (when the lump sum is included) is ¾d. per unit. The telephone system in electricity supply was conceived and brought forth for, among other reasons, enabling consumers to delude themselves as to what they are actually paying for current. There is to be this discount—for such business as is obtained in this way—during the summer months only; but in the winter time the present price is to remain. Is any member of the Council going to try electric cooking in his business establishment? If so, no doubt he has been very pleased to find that the councillors have agreed that the rebate shall be allowed all the year round, for non-peak cooking to businesses, being on the "telephone" system, and having large installations, where a considerable amount of day cooking is done for staff and customers. There is no doubt that the electrical business contains a variety of interest; but it is a brain-fatiguing job to remember the protean tariffs of some undertakings.

Mr. C. Orme Bastian has, for the time being, stopped talking about thermal storage; but he still adheres to the point that, to put it in the choice language that he uses, the inscription on a gas-meter "0·5 ft. per revolution," is a "lie." Very well. Of course, there is nothing more to be said; Mr. Bastian having spoken so emphatically. But we see that, in connection with thermal storage, he has a rival in America, in the person of Mr. William Stanley. This gentleman has constructed a stove to which 500 watts per hour are delivered continuously, and converted into heat, which is stored by means of his new device until it is required for use. The stove is thus described by the New York correspondent of the "Electrical Engineer":

The interior oven lining consists of an iron box, the bottom section of which is equipped with a cartridge type heating unit taking 200 watts. The exterior is thoroughly lagged, and at the opening the oven shell is adjusted to the outside wall by means of a throat of high thermal resistance material, which effectively minimizes the possibility of loss on opening the oven door. The oven walls form the storage mass, and the insulation is so proportioned to the energy required that the maximum temperature attained by the storage is approximately 250° C. A spiral calorite wire unit is placed in the top of the oven and is normally out of circuit. When it is desired to roast, switches are manipulated transferring the energy from the storage masses to the spiral unit in the oven top. In this way all the energy delivered to the range is concentrated upon the searing unit, heating it quickly to a radiant temperature. The joint in the oven receives this radiant heat, and is seared in a few minutes. As soon as the searing is completed, the switches are again thrown, and the energy is returned to the storage masses. In this way, the extra heat is obtained without calling for additional energy from the central station. The joint remains in the oven for the cooking period, during which time the oven walls part with some of their stored energy by radiation and by convection, heating and roasting the joint satisfactorily.

That is the description of the invention. We do not see (as we said when referring to Mr. Bastian's proposal) the use of introducing this additional complication into electric cooking and heating; seeing that, if (what virtue there is in an "if"!) we accept the electrical averment on the subject, already cooking and heating are as cheap as or cheaper than gas heating and cooking. But it seems that the inducement to the station engineer to encourage its use is that it will afford the supply station a valuable constant load; and to the householder that it will furnish cheap heat for cooking purposes—heat which will "cook faster than the coal or gas range." Even with such recommendations, we are not convinced that there is anything of value in thermal storage for commercially assisting the domestic business. However, we heartily hope the electricity industry will go on with the work of complication; such electrical complication serves the gas industry admirably.

There must be many places where electric radiators are in use that are ineffectively heated, and there must be many carbon filament lamps in stock that would like to find some useful occupation. Mr. Donald Smeaton Munro suggests that they shall be used extensively for electric heating. That is positively wicked.

"Light without heat" is the cry of the electrician; and then Mr. Munro comes along and says "the effective heating surface of five 50-watt pear-shaped lamps is considerably greater than the surface area of the standard 250-watt radiator lamp as ordinarily used." In advocating this use, he points to some of the disadvantages of the radiator lamps. "The filaments are long and delicate," and "they are in the worst position for heating an ascending column of air." This is a common experience; so that Mr. Munro has not done much harm in talking about it.

PERSONAL.

Acting on his doctor's urgent advice, Mr. CORBET WOODALL is taking a short holiday in the South of France.

We learn that Mr. JACQUES ABADY, who has been on a visit to America, arrived back in London last Saturday.

Mr. H. CAVAGHAN, of the Edinburgh Gas-Works, has been appointed Works Manager by the Wigton (Cumberland) Gas Company, in succession to Mr. S. Waite, who had been with the Company for forty-two years.

Mr. SIDNEY SMITH, Assistant Gas Engineer to the Bolton Corporation, has relinquished the position on obtaining an appointment as Chief Resident Engineer for a foreign Government, at a salary of £1500 per annum.

The Directors of the Wilmslow and Alderley Edge Gas Company have appointed Mr. C. E. HOLT, of Nuneaton, as Manager of their undertaking. Mr. Holt was engaged at the Heywood Corporation Gas-Works before he went to Nuneaton.

Application has been invited for the position of Gas Engineer to the Cleckheaton District Council. The cause is the retirement, through impaired health, of Mr. GEORGE NIVEN, who has been Gas Engineer to the Council for nearly thirty-five years.

Mr. J. H. BALFOUR BROWNE, K.C., whose name is well known to "JOURNAL" readers, not only for his extensive practice at the Bar, but also as a Past-President of the Society of British Gas Industries, has been elected Treasurer of the Middle Temple.

Mr. ROBERT D. ROBERTSON, late Assistant at the Airdrie Gas-Works, sailed on the 16th inst. to take up his duties as Manager of the Talcahuano (Chile) Gas-Works. Before leaving Airdrie, Mr. and Mrs. Robertson were the recipients of a presentation from the staff and employees at the gas-works. Mr. EDWIN ALLISON, of Londonderry, has been appointed Assistant at Airdrie, in succession to Mr. Robertson.

Mr. BERNARD F. BROWNE, son of Mr. A. F. Browne, of Vauxhall, and until about a year ago the Manager of the Primitiva Gas Company, has obtained the appointment of General Manager to the Santos City Improvements Company, Limited, who own and carry on the gas, water, electric light, power, and tramways undertakings of the city; and he will probably leave London for Brazil towards the close of the year. Mr. Arthur F. Phillips is the Consulting Engineer in London for the gas and water undertakings. We congratulate Mr. Browne on his selection for this important position, and also on his having recently passed the examination for associate membership of the Institution of Civil Engineers.

Mr. J. W. BROWN, who, as stated in the "JOURNAL" a fortnight ago, has resigned his position as Manager to the Chapel Whaley and District Gas Company to take a position with the South African Lighting Association, has been presented by the employees of the Company with a pair of prismatic binoculars in a case, as a mark of their esteem. Mr. J. H. Clark, making the presentation, spoke of the excellent relations which had always existed between Mr. Brown and the staff; and, on behalf of the subscribers, he wished the recipient every success in his new sphere of labour. Acknowledging the gift, Mr. Brown expressed the hope that the staff would extend to his successor, Mr. Eugene Meunier, the same hearty co-operation they had given him.

Mr. W. S. SMART, who, as already notified in the "JOURNAL," is leaving the Saltley works of the Birmingham Corporation Gas Department to take up the position of General Manager to Messrs. W. J. Jenkins and Co., Limited, of Retford, was last Tuesday evening presented by the staff with a silver coffee service. Mr. F. J. Bywater, in making the presentation, congratulated Mr. Smart on his appointment and eulogized the manner in which he had carried out his duties at Birmingham—expressing, also, the regret that the Gas Department felt in losing his services. On behalf of the staff, he wished Mr. Smart the best of luck in his new sphere. Dr. W. B. Davidson, Mr. James Hewett, and Mr. A. W. Smith endorsed these sentiments; and Mr. Smart suitably returned thanks for the good wishes and the handsome gift.

The death occurred last Wednesday, at the age of 82, of Mr. George Banbury, who was for many years Chairman of the East London Water Company, in which capacity he took a prominent part in arranging the terms of the transfer of the undertaking to the Metropolitan Water Board. Another gentleman who was for some years associated with one of the London Water Companies—Mr. Francis Tagart, a Director of the Grand Junction Company—has just been removed by death at the advanced age of 92.

SOCIETY OF BRITISH GAS INDUSTRIES.

The Autumn General Meeting of the Society was held last Thursday, at the Holborn Restaurant. There was a good muster of members. During the transaction of the ordinary business, Mr. H. JAMES YATES was in the chair. Afterwards the PRESIDENT (Professor Smithells, F.R.S., of Leeds University) succeeded him.

MR. CORBET WOODALL, PRESIDENT-ELECT.

The CHAIRMAN said he had to advise the members that Mr. Corbet Woodall had kindly consented to accept the presidency of the Society for next year. He (the Chairman) considered this a very happy augury indeed. As the members were aware, Mr. Woodall had also consented to occupy the presidential chair of the Institution of Gas Engineers next year, as it was the Jubilee Year of that body. He thought it a very happy thing that this should have happened so far as the Society was concerned, as it would lead still more to what he should dwell upon in the paper to be read at the present meeting—on co-operation on all sides of the industry. The Chairman then referred to changes in the arrangements for the meetings—the principal one being that guests will be invited to the spring meeting and dinner when the Presidential Address is delivered, instead of, as hitherto, to the autumn meeting; and for the future music and other entertainment is to take the place of speeches after dinner. He also referred to the winning of the Yates golf bowl (to be competed for annually by the members) by Mr. P. B. de Clegg-Mellor, who will hold it for a year, or such further time as he could in competition retain it. The members who entered the first competition had, however, decided that the winner should also have a small silver replica of the bowl to permanently remind him of the successful day that he had when he won the bowl.

SUBSCRIPTION TO THE BRITISH COMMERCIAL GAS ASSOCIATION.

The CHAIRMAN said they would be obliged that night to decide what sum the Society were going to subscribe annually to the new British Commercial Gas Association. Unfortunately, until that day the members of the Society had not been officially supplied with the rules of the Association, and therefore they had not had any opportunity of studying them. The object of the Association was to promote the commercial prosperity of the gas industry by co-operative action. The intention was that the Association should carry on a good propaganda with respect to gas, to bring home to people the advantages of using gas, and to correct many of the misstatements made by the rival industries. United as a whole, both gas apparatus makers and gas suppliers, they made a formidable body; and if it was properly supported, he thought that nothing but good could come from the work. There was one thing that must be remembered, and it was that advertising was a very expensive thing, and that a few thousand pounds would go nowhere. If, therefore, the British Commercial Gas Association was not supported on proper lines, it could not be the success that it ought to be. He pointed out some time ago in another place that, if they did not support the Association with a sufficient sum of money, at the end of the year the members would be asking what had been done with the money that had been spent. It took a great deal of money to create any real effect; but if they spent sufficient money, he knew from his own experience, that they would derive substantial benefit from it. He hoped that night the members would support the new Association to the best of their ability. By a subscription of £2000, the the Society would have good representation in the management of the affairs of the Association. They would have a Vice-President, eleven members in the Association, four members on the General Committee, and two members on the Executive Committee. The Council that morning had nominated the members, and also the members for the General Committee; and the names would presently be submitted for confirmation.

There was some discussion on the question of procedure—Mr. A. P. Main, Mr. F. C. Tilley, Mr. T. S. Clapham, Mr. J. W. Broadhead, Mr. Thomas Glover, Mr. W. D. Helps, Mr. Cyril G. Davis, and others taking part in the discussion; the outcome being that it was left to the Chairmen of the Sections to consult with the members as to the amount of their contribution.

Mr. F. J. WEST moved—"That the Society pledges itself to endeavour to raise £2000 as an annual contribution to the British Commercial Gas Association."

Mr. F. TEMPLER DEPREE seconded the motion; and it was unanimously carried.

The CHAIRMAN said, from the indications he had received, he had no fear about getting the £2000 a year.

INTERNATIONAL GAS EXHIBITION.

The CHAIRMAN intimated that it was proposed to hold a large Gas Exhibition in 1913. A communication had been received from the Institution of Gas Engineers, asking the Council to nominate six members to meet the Council of the Institution to discuss the matter. The Council of the Society had accordingly nominated six members that morning for the purpose; and a suitable date for a conference would next be arranged. Of course, the Society could only associate themselves with the exhibition provided it was arranged on lines entirely satisfactory to them. The Institution were looking to this exhibition as a great feature in the commemoration of its jubilee year. The members nomi-

nated to serve were Messrs. Cyril Davis, F. J. West, H. M. Thornton, T. S. Clapham, W. D. Helps, and H. James Yates.

On the motion of Mr. JOHN MACKAY, seconded by Mr. W. P. GIBBONS, the Council were authorized to act in the matter in the manner suggested.

REPRESENTATION IN THE COMMERCIAL GAS ASSOCIATION.

The CHAIRMAN remarked that the Council had up to the present nominated ten members as members of the new Association. If the subscription reached £2000, the Society would be entitled to another member. The present members nominated were: Messrs. Thomas Glover, J. W. Broadhead, W. D. Helps, F. J. West, T. S. Clapham, F. Templer Depree, Charles Clare, C. G. Davis, H. M. Thornton, and H. James Yates.

Moved by Mr. J. W. GLOVER, seconded by Mr. W. A. DRAKE, the nominations were confirmed.

The CHAIRMAN said the Council had done him the honour of electing him Vice-President of the new Association, with Messrs. Thornton, West, and Helps to serve on the General Committee.

On the proposition of Mr. W. P. GIBBONS, seconded by Mr. JOSEPH TAYLOR, these nominations were also approved.

The CHAIRMAN mentioned that the Executive Committee would be formed from the General Committee; but by the rules two members of the Executive Committee must be members of the Society.

This concluded the general business; and

The PRESIDENT (Professor Smithells) then took the chair.

SCIENCE AND CO-OPERATION IN THE GAS INDUSTRIES.

Mr. H. JAMES YATES read a paper on this subject. Together with a report of the discussion, it appears on pp. 608-12.

THE YATES GOLF CUP.

The PRESIDENT next presented this cup to the first winner Mr. P. B. de Clegg-Mellor, together with a silver replica which wil remain his permanent possession, while the cup proper will only remain with him for a year, or such longer period as he can retain it against his competitors.

Mr. DE CLEGG-MELLOR, briefly, but heartily, acknowledged the presentation and gift.

VOTE OF THANKS TO THE PRESIDENT.

On the motion of the CHAIRMAN, a cordial vote of thanks was passed to the President.

This terminated the business proceedings.

DINNER AND MUSIC.

Shortly afterwards, the members dined together, with Professor Smithells in the chair. On this occasion there were no visitors, as it has been determined that it would be more appropriate for invitations to be issued on the occasion of the meeting when the President delivers his Inaugural Address. Another innovation was introduced on this occasion, and will be continued. The members are not in future to be subject to the "traditional form of torture" in the shape of speeches after enjoying their dinners, and other than remarks accompanying the toast of "The King," there will be no other toasts. Instead, there will be a musical entertainment. This was the arrangement on this occasion; and it was vastly enjoyed by all present.

DETERMINATION OF SULPHUR IN GAS.

A paper which has been published in a recent number of the "Journal für Gasbeleuchtung" describes a method elaborated by Herr J. Niermeyer, of Groningen, for the determination of sulphur in illuminating gas, which is substantially the same as that described by Mr. C. Winthrope Somerville in the "JOURNAL" for Oct. 4, 1910 [Vol. CII., p. 28]. Herr Niermeyer, who states that he made his investigations in the summer of 1910 in the laboratory of the German Continental Gas Company at Dessau, says that he now describes his exact procedure because Mr. Somerville appears to have overlooked two important points in connection with the use of the method.

Herr Niermeyer refers to investigations made by Dennstedt and Ahrens in 1896 ["JOURNAL," Vol. LXVII., p. 977], in which they showed that the ratio between the proportions of sulphur dioxide and sulphur trioxide in the products of combustion of illuminating gas varies only a little. They found 92 to 94 per cent. of the total sulphur in the form of sulphur dioxide, and 6 to 8 per cent. in the form of sulphur trioxide. [The relative proportions of the two oxides of sulphur will doubtless vary somewhat with the type of burner in which the gas is consumed—see Collan's researches, "JOURNAL," Vol. LXVI., p. 729.—ED. J.G.L.] Since sulphur dioxide can be determined in quite small quantities with great precision by means of iodine, the nearly constant ratio between the proportions of sulphur dioxide and sulphur trioxide in the products of combustion of gas admits of the amount of sulphur in the gas being determined through the reaction between sulphur dioxide and iodine. The values found for the sulphur contained in the sulphur dioxide from a given quantity of gas should be increased by 6 to 8 per cent. by way of allowance for the sulphur which has been burned to sulphur trioxide; and the total quantity of sulphur in the gas will thus have been estimated with tolerable precision.

Herr Niermeyer aspirates the products of combustion through a centinormal solution of iodine. He points out that in the ordinary way it would be necessary to follow the absorption vessel by a vessel containing sodium thiosulphate, in order to retain any iodine which has been volatilized. With the object, however, of working with only one absorption vessel, he increases the amount of potassium iodide in the iodine solution in order to prevent the volatilization of the iodine by diminishing its partial tension in the solution. He has found that an addition of 10 cc. of 10 per cent. solution of potassium iodide to 10 cc. of centinormal solution of iodine is the proper proportion.

It is pointed out that in an ordinarily well-ventilated laboratory it is superfluous to purify from sulphur compounds the air used for combustion, as is done in the case of the Drehschmidt apparatus for the determination of sulphur in gas. The products of combustion are cooled by a condenser before being passed into the solution of iodine, which is contained in an efficient washing bottle. A vacuum pump is used to draw the products through the apparatus. Obviously, the use of rubber connections should be avoided as much as possible. The gas is burned at the rate of 70 to 80 litres (2·5 to 2·8 cubic feet) an hour. The wash-bottle is charged with 10 cc. of centinormal solution of iodine, 10 cc. of 10 per cent. solution of potassium iodide, a few drops of solution of starch, and 50 cc. of water. A moderately strong stream of air is drawn through; and as soon as the hand of the gas-meter passes the zero mark, the burner is put below the glass tube of the condenser of the apparatus. The brownish absorbent first becomes blue and finally colourless, at which point the position of the index of the meter is again read. At the rate of consumption stated, 6 per cent. is added to the amount of sulphur found; but if a smaller rate of consumption—30 litres (1·06 cubic feet) per hour for instance—is employed, the correction should be an addition of 8 per cent.

Herr Niermeyer has checked the accuracy of his method by comparisons of it with the hydrogen peroxide method on gas stored in an experimental holder, and has found a good agreement. He considers that Somerville has overlooked two points—viz., (1) that the results should be corrected by an addition of 6 per cent. because all the sulphur is not burned to sulphur dioxide; and (2) that an excess of potassium iodide must be used, as otherwise it is possible to find double the amount of sulphur which is actually present.

INEXPENSIVE INVERTED PENDANT LAMPS.

The accompanying illustrations show two new styles of lamp for making up inexpensive inverted pendants. The smaller fitting is an oxidized copper lantern, with muffled glass, to take a bijou

Two Inverted Pendant Lamps.

burner; and the larger one is also fitted with muffled glass, but is arranged for a standard size inverted burner. Attention is drawn to the lamps (both of which are of an attractive pattern) by Messrs. J. & W. B. Smith, of Farringdon Road, E.C.

Masonic.—At the regular meeting of the "Evening Star Lodge," No. 1719, held at the Freemasons' Hall, last Wednesday, W.Bro. C. W. Offord, of Enfield, was elected W.M. for 1912, in succession to W.Bro. Cyril G. Davis; and W.Bro. Thomas Cash, P.M., was elected Treasurer of the lodge, in place of W.Bro. T. E. Priestman, P.M., L.R., who has occupied the position for the past two years.

Calorific Power of Gas.—We have received from the publishers, Messrs. Charles Griffin and Co., Limited, of Exeter Street, Strand, a work, bearing the above title, by Mr. J. H. Coste, F.I.C., F.C.S. It is a treatise on calorific standards and calorimetry; and the author states in his preface that it is intended principally for those who actually have to examine gas and advise on matters of testing, whether as official gas examiners, works' chemists or engineers, or consultants. The book, the price of which is 6s. net, will be noticed more fully in a subsequent issue.

THE BARREN DEFENCE

OF THE "ENGINEERING CORRESPONDENT" OF THE "DAILY TELEGRAPH."

The Editorial Criticism.

UNDER the terms laid down by the "Engineering Correspondent" of the "Daily Telegraph," his article, headed "Some Aspects of Lighting," has had a week's circulation and publicity through the "JOURNAL" before any editorial comment has been made. It will be remembered that the condition was: "That you will refrain from editorial comment until the next issue of publication." The delay in the publication of editorial comment is therefore not our seeking, but "Engineering Correspondent's." He has had his turn; now it is ours.

It will be remembered that this controversy arose out of a series of articles which the "Engineering Correspondent" of the "Daily Telegraph" wrote, which were published in our morning contemporary, and which were, in our judgment, so absolutely unfair to the gas industry, and exhibited such a strong electrical tone, that we criticized them (*ante*, pp. 93, 167, 253, 326). At the same time, we put to our friend a number of questions, with the view, if he would deal with them, of ascertaining the strength of the foundation upon which reposed the dogmatic and injurious statements that he had made, for public consumption, in a paper with a large circulation among the public, concerning the gas industry's staple commodity and appliances, in contrast with those of its chief rival. We protest against a newspaper of such standing giving opportunities for this sort of thing from one who (this is his own admission) "to some extent pleads guilty" to being biassed, without giving a properly qualified person representing the industry whose interests are publicly assailed an opportunity for equal publicity in presenting its case in the same columns. While this continues, a paper of the standing of the "Daily Telegraph" cannot plead that it is acting justly to all parties.

However, in our criticism of Oct. 17 (p. 167), referring to our article of the previous week, we said:

> In our article, we put a number of questions to our friend that were pertinent to the definite and dogmatic assertions that he had made. But he has entirely avoided them; and, in their place, we have bald statement, and a circuitous writing in regard to only a few of the questions. We should like "Engineering Correspondent" to re-read our article, and to take up the points that he has omitted, and if there is not room for the result to be published in the "Daily Telegraph," we shall be pleased to give him the necessary space in, and publicity through, our own columns, together with the shelter of the *nom de plume* "Engineering Correspondent."

We had very fair reasons for suspecting that the strength of the gas knowledge of our friend was not such as to justify the statements he had made; and we desired to obtain from him an indication of that knowledge, to see how far it would vindicate the assertive attitude he had taken in his articles. A week later he accepted our invitation, with these singular conditions attached:

> (1) That you will print my article as sent to you.
> (2) That all correspondence on articles from me appearing in your "JOURNAL" will be paid for at your usual contributors' rates.
> (3) That you will refrain from editorial comment until the next issue of publication.
> (4) That you will print the article within fourteen days of its receipt.

We accepted the conditions, provided that the article did not contain personal references, or comment upon matters that were the subject of contract that would bring us into collision with third parties. We were perfectly indifferent as to anything the "Engineering Correspondent" cared to say about us. We were also willing that his contribution should not go monetarily unrewarded. We made one more condition. It was this—

> In order, too, that controversy may not rove over too wide a field, we will ask our correspondent to confine his communication to those matters that were treated upon in his articles, and to which exception was taken, or upon which definite information was asked of him.

This condition he has violated through the greater part of his article; but, even so, we are willing to deal with the new matter, and we hope to his satisfaction.

What do we find? A week later, in both the "Daily Telegraph" and the "JOURNAL," the "Engineering Correspondent" was asking for figures for him to investigate. That was precisely what we did not want. We desired to find from the author of the articles which were the object of our criticism the condition—the degree of soundness and solidity—of the personal knowledge that justified him in writing as he had done in the columns of the "Daily Telegraph." We have little patience with people who set out to attack other people's interests without having already in their possession a strong backing to support them in the event of their being called to account for their proceedings. The request for figures, and last week's article (which we suppose we may take as the best that "Engineering Correspondent" can do under the circumstances of the present, which circumstances are only a little removed from those under which he wrote his "Daily Telegraph" articles) show the indigent character of his information on the questions upon which he pronounced what we consider to be an arbitrary judgment.

IS "ENGINEERING CORRESPONDENT'S" ARTICLE A FAIR AND FULL JUSTIFICATION?

We say deliberately "It is not." Among our readers, we have many electrical engineers; we have readers who are interested, technically, commercially, and financially, in one way or another, in both the gas and electrical industries. We ask the most impartial of these, we ask all of our readers who claim to be able to form a sound judgment, whether the article printed in last week's issue is a fair defence of the statements appearing in the "Daily Telegraph" articles of which complaint was made, or is in any way a vindication of the statements to which we took exception? We will see directly how far the article goes in justifying in any one particular the "Engineering Correspondent's" original statements.

Early in the article published last week, "Engineering Correspondent" says he proposed in it to take up the points we had raised, "so far as is reasonable with space limitations." We made no limitations as to space in inviting him to defend himself; the limitation we made was as to confining his reply to those points to which we had taken exception. We cannot tell exactly how to regard our friend. He does not appear to like editorial opinion; but he copiously showers his personal opinions upon the gas industry. The height, too, at which he instals himself is well portrayed in his words: "He will tell the great industry a few home truths, which may mean bitter moments while reading, but which, if taken in a true English spirit, should, at any rate, lift the scales from the eyes of some of its votaries." The "may mean" betore the "bitter moments" was an ingenious safeguard; for the "moments" spent in reading the article have been, we venture to think, for our readers who live in and among the industry's affairs, and do not examine them from afar off, peculiarly felicitous ones.

OUR QUESTIONS, AND HOW FAR THEY ARE ANSWERED.

The first point to which we took exception in our article of Oct. 10 (p. 93) was as to the superiority of the arc lamp for shops, streets, and workshops. Wrote our critic: "The golden lights from these [flame arc] lamps is unequalled for lighting shop exteriors." "They are superior to incandescent gas in all respects." We asked "Engineering Correspondent"—

> Whether he had seen the high-pressure lighting with the new inverted lamps in Whitehall and other parts of Westminster, and the low-pressure inverted gas-lamps there and elsewhere; whether he ever saw a more equally diffused, brilliant, and steadier illumination by means of flame arc lamps of like candle power.

No answer has been given to any one of these questions.

> Next we pointed to the extensive adoption of high-pressure inverted lamps for shop lighting in and about London. We pointed out how a considerable number of electric arc lamps have been displaced by these new high-pressure inverted gas-lamps—in two roads alone to the number of 111. [We know of another road where about 100 arc lamps have been displaced.] We asked him to tell us why these things are if the flame arc lamp has established such an enviable position as he alleged.

He has not done so.

> We requested him to examine into the truth of what we said in this latter particular by paying visits to the districts named; and then to do the gas industry the justice of acknowledging the truth with the same prominence that his "Golden Lights" article received.

He has not done so.

> We asked him to supply us with information as to the tests made with incandescent mantles. [See the nature of request in our article.]

He has not done so.

> He spoke of the reduction of mantles to ruins. We suggested that probably he had never heard of windproof gas lanterns; and of the longevity—in practice, and not in imagination—of the inverted gas-mantle upon its rigid support.

He has not informed us upon these points.

> He stated that certain costs were, "by combined working, of course, impossible with any other illuminant than electricity." We asked him to explain why "of course," and why "impossible."

He has not done so.

> We asked him whether, comparing certain figures quoted from Mr. W. B. Farquhar's Eastern Counties' Association paper, the figures that he ("Engineering Correspondent") quoted for arc lamps included all that was embraced in the Ilford price?

He does not reply.

> In his article he stated that there were no products of combustion from the arc lamp, which was an important

point for shops. We quoted against him Professor Marchant; and he has had the courtesy since to mention this point in the "Daily Telegraph."

How came the "Engineering Correspondent"—a "scientific investigator"—to make the original statement in the columns of the "Daily Telegraph"? He does not explain.

We challenged him for his authority, and to say categorically what he meant by the statement: "That every house should be lighted electrically for the good health of the occupiers is the *unanimous* opinion of doctors and scientists."

He does not reply.

He pointed to the pernicious effect of sulphur compounds on paint, leather, bindings of books, &c.

He is here attacking gas lighting under the conditions of to-day's use. He has not advanced anything in defence of the insinuation he made.

He asserted that a gas-burner pours out as much carbonic acid into the air as do two adult persons. We challenged him as to the accuracy of this. We asked him to deal with a concrete case; also to explain the noxious difference between the carbonic acid from an incandescent burner and that given off by human respiration.

He has not dealt with any of these questions.

He spoke of the "absence" of the danger from fire with electricity. We challenged him on this point.

He has not responded.

We sought, in the article for Oct. 17 (p. 167), to get him to reconcile the statement as to his desire "to see both of the great industries flourish," with his views as to the flame arc lamp being "superior to incandescent gas in all respects," and as to his frank preference "to see *all* indoor lighting done by electricity, and the current applied to other purposes." We failed to see how the gas industry could "flourish" under such circumstances.

"Engineering Correspondent" does not favour us with an explanation.

We therefore claim that the article published last week in our columns is no defence whatever of the article published in the "Daily Telegraph," nor is it a justification of the statements to which we took exception.

Let us see of what it is composed.

(1) In the first place, it recapitulates the reasons for writing the article.

(2) It then treats, in a friendly spirit, with the "bias" of the Editor of the "JOURNAL;" and "Engineering Correspondent" confesses that if he held the position "he also would be biassed, possibly more biassed than the Editor." He pleads guilty to himself being, "to some extent," biassed electrically. On these matters, so far, over one column of the "JOURNAL" is occupied.

(3) Then about the same space is devoted to an examination (on wrong bases) of the costs of high-pressure gas lighting.

(4) Succeeding are some personal views on the calorific power of gas in relation to incandescent gas lighting.

(5) There follows further proof of the poverty of information possessed by the "Engineering Correspondent" at the time he published his "Golden Lights" article.

(6) A discussion succeeds of metallic filament lamps in comparison with old upright incandescent gas-lamps, and not the new forms of inverteds.

(7) The article concludes with a miscellaneous collection of points.

This summary of the composition of the article shows that the "Engineering Correspondent" has failed to deal with the questions we pointedly put to him, as already summarized.

All that "Engineering Correspondent" has to say concerning points Nos. 1 and 2 is not pertinent to the matters that originated this discussion; and we will let his views on the subject of bias stand for what they are worth, with just the one remark that the "Golden Lights" article is a sample of the frequent evidence that comes before us of the need for watchfulness and for critics on behalf of the gas industry.

COSTS, HYPOTHESIS, AND MISREPRESENTATION OF THE CURRENT POSITION.

Coming now to the question of costs, we preface the discussion of the figures of "Engineering Correspondent" by pointing out that they are—

(1) Largely hypothetical.

(2) Or mostly based on burners or lamps installed years ago, and which are not typical of the best of the patterns of 1911.

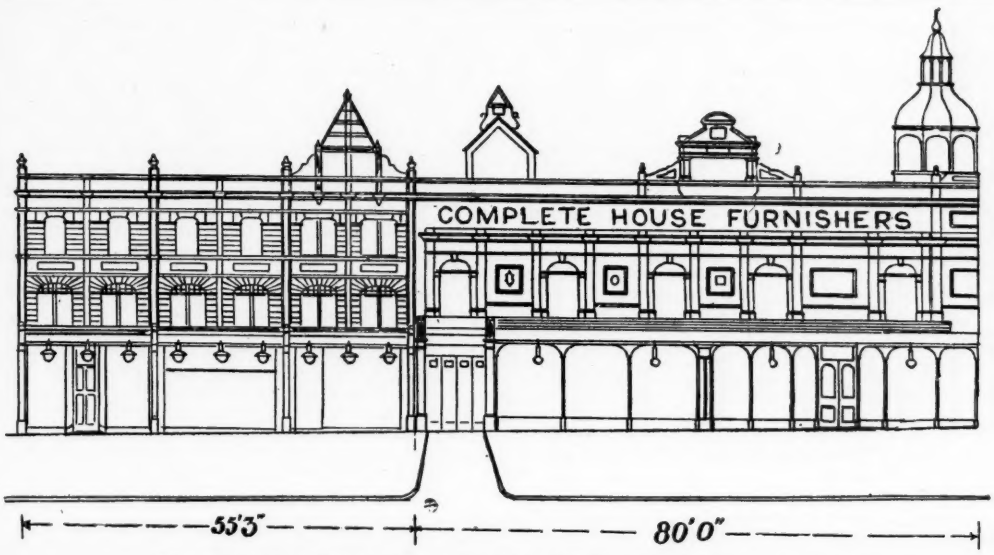
If this is the representation of the knowledge that really existed in the mind of "Engineering Correspondent" when he wrote his "Golden Lights" article, then we think he must confess before we have finished with him that he took a very strong attitude on very slender grounds in postulating as he did. Surely a man "trained in science" cannot so easily forfeit his claims to precision as to back up his opinions in 1911 by the performances of appliances that advances have put out of date! If he does this, he ought not to expect any assistance whatever from the gas industry until he can justify what he has already said, or admit that he was not, *in the state of his knowledge in October*, justified in publishing the statements he then made.

WOOLWICH SHOP LIGHTING.

Regarding the Woolwich figures relating to the lighting of the exterior of two shops, there is little sense in discussing figures on the insecure foundation given. But we are going to deal with the matter on the superficial statements of "Engineering Correspondent's" article, and then we have something stronger to say. Respecting first the attitude of the South Metropolitan Gas Company in refusing, "for reasons which they stated" (but which "Engineering Correspondent" does not quote, regarding them doubtless as confidential), to make any comment on the prices other than that the electricity works have a large debt. When one comes to think over it, it is rather impertinent—we admit the suggestion—to ask one trader (who is making a good dividend, and maintaining and depreciating and placing to reserve on a good scale) to divulge to his competitors by analysis the components of prices upon which he does business. We do not make this point as any criticism or as any excuse for the figures given for the two Woolwich shops in question. But surely "Engineering Correspondent" does not take these two isolated Woolwich shops as a standard upon which to assert that the gas industry trades with a more expensive light than the electric industry. There is the large adoption by tradesmen—the extensive installations—of the new inverted high-pressure gas-lamp in the shopping districts of London to be accounted for by "Engineering Correspondent" as a set-off to this little example of two Woolwich shops. The lamps have been adopted in numerous electricity suppliers' districts, in roads through which run electric cables, and with electricity on offer at prices per unit below those charged for lighting to the ordinary consumers. He has to account for the displacement of electric arc lamps by these high-pressure gas-lights in these various districts, and notably the 111 electric arcs in two roads in the Hammersmith area. There were reasons for the displacing of arc lamps there and elsewhere. Does "Engineering Correspondent" say, on the strength of the two shops at Woolwich that the hundreds of tradesmen in different parts of London who have adopted the high-pressure gas-lamps, and those who have given up electric lamps, are a pack of fools? And does he say, too, that all gas companies who are doing this business are doing it at a loss? Let him appeal to his commonsense, and not take cover, in a matter of commerce, behind the plea that his scientifically cultivated mind cries out for analyses of costs, in order that he may examine them, as well as facts. Is not the fact substantial enough that these lamps are in existence and in daily use north, east, south, and west, and that they are there in open competition with electricity? It will, of course, be understood by him that we do not say that a company of the dimensions of the Gaslight and Coke Company or the South Metropolitan Gas Company supply these lamps at like prices throughout their extensive areas—comprising the districts of several Borough Councils, and in which business has to be done in competition with electricity suppliers at different prices, and under magnitude conditions of installation that make it possible to work at variable prices per lamp.

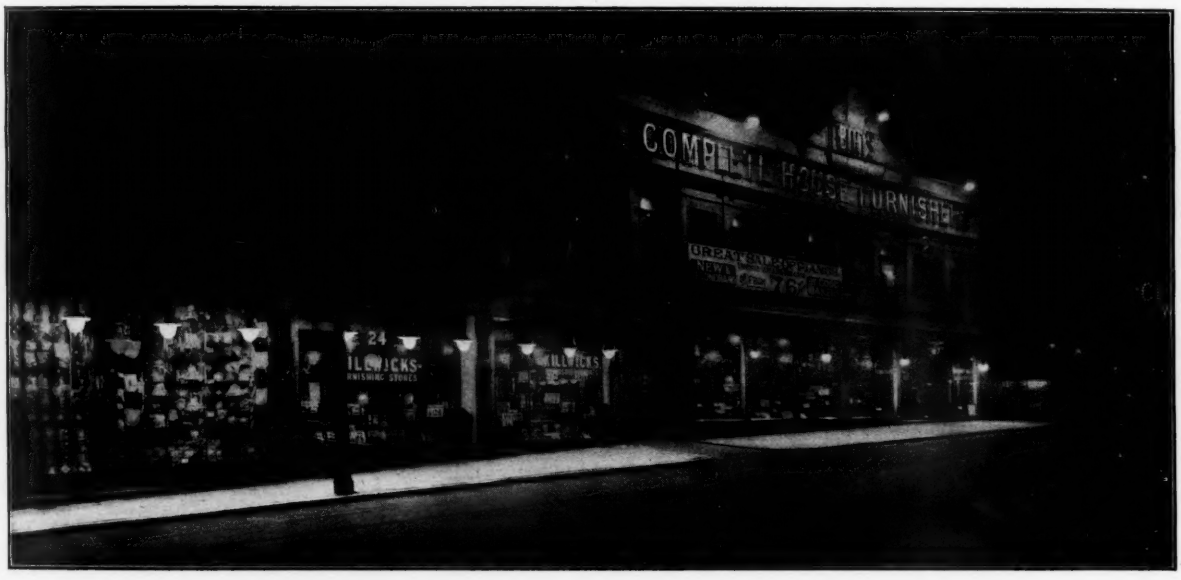
"Engineering Correspondent" suggests that the illumination from the high-pressure gas-lamps suffers somewhat from the extreme glare from the mantles in clear globes. He treads on very dangerous ground when he talks of "glare." Does he not know that the softer light from these lamps than from flame arcs even in opal globes is one of the several advantages that appeal to the shopkeepers? If he has not seen flame arc lamps just a few feet above one's head in front of shops with an insufferable glare about them, he must have been walking the streets of London with his eyes shut. But as to the costs, "Engineering Correspondent" appeals for facts. In this Woolwich case, he gives his "own estimate," which (so he says) shows that the current is supplied at 3d. per unit. It is all estimate that he offers. He takes the working hours at 800 in both cases—gas and electricity. We do not know that this is true. In his article, he does not state the number of the flame arcs. He says they are 10-ampere ones; he does not say anything about the voltage. In the last paragraph but one of the article, "Engineering Correspondent" remarks: "Quoting the price of gas per 1000 cubic feet, without giving the heating power, is like quoting amperes of electricity with no mention of pressures. The electrical engineer who did that *would be ridiculed by any man of science*." Very well. Then let "Engineering Correspondent" ridicule himself for his omission in the case of Woolwich. There is nothing in what he puts forward in his article that can enable us to judge of the accuracy of his figures for electricity. They are all hypothetical, though, of course, we are able to assume from the units quoted that he takes four 10-ampere lamps, and the voltage at 210.

In his "Golden Lights" article, "Engineering Correspondent" was talking about flame arc lamps being supplied at an inclusive price of 1¾d. per hour. He did not, however, mention the candle power of the lamps. By so doing, he saved himself. We have flame arc lamps under test observation; and the carbons are working out to a higher rate than is given in this Woolwich table. As to wear and tear, the flame arc lamp very rapidly depreciates. We are of opinion, from experience so far with high-pressure inverted gas-lamps, that they will show well against the flame arc lamp in this respect; anyway, they will not be worse. We will give the flame arc lamp all the narrow cutting-down that "Engineering Correspondent" has granted it in his computation, and take his figure of 3d. per unit—a figure at which "under proper management and financial conditions," he says, "it is commercially possible to generate and distribute electricity for lighting purposes." Taking these figures as they stand, they work out to



[The Shop on the Left-hand Side is the one Lighted by Nine High-Pressure Gas-Lamps.]

Illustration showing the Drawing on the Woolwich Circular, without the Three Top Flame Arc Lamps.



Photograph showing the Premises in Question with Seven (not Four) Flame Arc Lamps.

2·4d. per 1000 candle-hours—using a figure approximate to theoretical efficiency claims. But "Engineering Correspondent" was speaking of 1⅛d. per hour in his original article. Assuming he meant a 1000-candle power lamp, what profit would there be in such a class of business for the electricity supplier? Taking again his figures and 1d. per unit (which is the rate at which several electricity undertakings are trying to do this business in competition with high-pressure gas lighting), the figures would only work out to 1·35d. per 1000 candle-hours, including everything. Upon reflection, we think that "Engineering Correspondent" must confess that he quoted a figure to the public—assuming he meant a nominal 1000-candle power lamp—that has no commercial solidity about it for an electricity undertaking, especially if he has under-estimated, as experience suggests he has, the other items. But, as we have said, beyond this reference, there is not much good discussing hypothetical calculations.

There is a general point, in reference to the statements as to the even illumination of these Woolwich shop fronts, that we may make. "Engineering Correspondent" has an immense respect for the work and opinions of Professor Morris in connection with the photometrical measurement of lamps. In March, 1910, at the meeting of the Illuminating Engineering Society, Professor Morris, referring to the Keith high-pressure inverted gas-lamp, said: "His experience with these lamps was that the intensity of the beam was considerably steadier than that of the electric arc lamp, so far as rapid changes were concerned." "Regarding flame carbon lamps (hand fed), they were not capable of giving such constancy of results, as could be seen by the way the observations were peppered about on the diagram. There was further difficulty with complete lamps which contain feeding mechanism." On the same occasion, Professor Sumpner (Birmingham) dealt with the erratic illumination by flame arcs; among his remarks being: "There are very few arc lamps that were constant for more than a fraction of a second."

The Whole Truth, and Nothing But the Truth.

Now we come to something more substantial about this Woolwich shop lighting, upon which "Engineering Correspondent" so affectionately relies. We, too, have obtained a copy of the precious circular issued by the Electricity Department concerning the two shops at Green's End; we also have been to Woolwich; and further we have had an interview with the head of the firm of Birts and Son and their Manager, whose establishment is the electrically lighted one. As a result, we say that in the circular and in "Engineering Correspondent's" article, there is a suppression of some very material facts—that is to say, material to this controversy. "Engineering Correspondent's" figures show us that there are four 10-ampere lamps lighting this frontage. He tells us that, with an assistant, he has visited Woolwich, has examined the row of shops mentioned in the previous article, and has made measurements, by photometer, of the horizontal illumination 12 feet from the shop windows and 4 feet from the ground. How did "Engineering Correspondent" and his assistant fail to see (as the illustration in the Woolwich circular fails to depict) three more 10-ampere flame-arc lamps suspended from the front of the premises in the neighbourhood of the words "Complete House Furnishers?" He represents to us, by his cost figures, that there are only four arc lamps yielding light along this frontage; while (as the photograph we have reproduced shows) there is a line of four arc lamps and three above—*seven* arc lamps in all. Why did not—we ask this emphatically—"Engineering Correspondent" divulge this material fact? It is all frontage lighting; it is all contributing to the light 4 feet from the ground and 12 feet from the windows. Mr. Birts and his Manager both assured us that they had no know-

ledge of at any time the line of four lamps having been in use without the three above; they had no knowledge of any illumination tests having been made with only four lamps running. We have thus a right to assume that the seven lights were running when "Engineering Correspondent" states that he made his photometrical measurements. Besides the seven lamps, the windows of the place are illuminated inside by seven high-power metallic filament lamps; while *some* of the windows of the premises of Faith Bros., next door are not illuminated by interior lamps at all, but rely solely, and with good effect, upon the high-pressure gas-lamps outside. The "Engineering Correspondent" states that he took his measurements 12 feet from the shop windows—precisely the same distance as is mentioned on the Woolwich Electricity Department's circular. The South Metropolitan Gas Company's lamps are there to light the shop windows, and not 12 feet away in the roadway. It is the business of the Borough Council to light the roadway; the Gas Company's business is to light the windows of the firm paying them for light, and this they do in a manner—plenty of light, soft, and steady—that not only pleases the firm in question, but succeeds in inducing other owners of business establishments to adopt the light. We have a perfect right to ask our critic, why he did not mention the fact as to the existence of the three top lights? However, notwithstanding that there are seven flame-arc lamps—four at a low level (standing at least a foot farther from the shop windows than the neighbouring high-pressure lamps) and three at a higher level—"Engineering Correspondent" testifies that the illumination over the whole front (high-pressure gas and flame arc lamp lighted) is "strikingly uniform."

We go farther. "The definite quotation of the two authorities for that site," says "Engineering Correspondent," "is £45 per 55 feet frontage for gas and £32 for 80 feet frontage for electricity." The electrical circular says the price per flame arc lamp is £8 per lamp per annum, including hire and maintenance. "Cost of lighting the frontage, 80 feet, at the above terms, £32 per annum." We inquired of Mr. Birts and his Manager whether the £8 was correct. They said it was, and that £8 was paid for each of the whole seven lamps. Therefore, the electric lamps attached to the front of these premises are costing £56, against the £45 paid by the next-door shop for nine 1000-candle power high-pressure gas-lamps. The traders in the neighbourhood have received the circular from the Woolwich Electricity Department; and they have shown their appreciation of its inaccuracies by adopting high-power gas-lamps. The circular is doing the Gas Company no harm. As a matter of fact, they are using it and the installations referred to in it in cultivating their high-pressure business. We could say more on the subject of this Woolwich shop lighting; but we will refrain, and end it with the remark that on these facts we, our readers, the readers of the "Daily Telegraph," and lastly but yet foremost the South Metropolitan Gas Company, have a right to an explanation from "Engineering Correspondent," who as a "scientific investigator," as one "scientifically trained," as one who wishes the gas industry to "face facts," must hold that truth should have supremacy.

There is one more point about the Woolwich circular. When it was first issued, the Electricity Department stated in it that these high-pressure lamps were charged at £6 apiece; and that the total cost of the nine per annum was £54. It only shows how little the Department knew of the matter. We accept the statement that these prices were given in error; but the Electricity Department had to promptly rectify them by despatching an amendment to all to whom the circular had been issued. This shows the necessity of making sure of one's facts in one's business methods.

Basis of Calculation.

The gas industry is living and operating under the conditions of 1911, and not of 1908. It is, as we have remarked, not a little surprising that a scientifically trained man, whose soul yearns for precision, should be content with comparing the gas industry's affairs of 1911 in the light of 1908—and that light defective in several respects. "Engineering Correspondent" is in a hopeless muddle; and it is on such evidence as we are about to censure that the critic and adviser of the gas industry has presumed to make his attack.

"Engineering Correspondent" takes (1) figures published by Professor Morris in 1908, as a basis for the consumption and candle power of the Keith inverted high-pressure lamp (30 cubic feet of gas per 1000-candle lamp, or an efficiency of only 33 candles per cubic foot!)—a less efficiency than most of our lamp makers will to-day *guarantee* for shop lamps under low pressure. We are afraid Professor Morris had in some way his lamp adjustments seriously wrong. This is indicated by the gas consumptions of the lamps tested. (2) Our critic takes an old report by Mr. Bradley, the City Engineer of Westminster, which (we stand subject to correction) referred to lamps in Whitehall—the candle power indicates it—which were erected some *years ago* (apparently upright burners), and which gave 985 candles, with a gas consumption of 28 cubic feet per hour. (3) He relies on a report regarding Marylebone made in 1908, dealing with old vertical burners, and not the inverted burners of to-day. Does "Engineering Correspondent" call this fair, or the "English spirit?" Does he hold that his foundation in this matter is a sufficient one upon which a man with a scientifically trained mind could construct the "Golden Lights" article in October last? We leave him to answer.

The falsity of his position has attestation throughout the country. The makers of the Keith lamps, if they know where these lamps are to be used, and the conditions of the gas supply, can construct them so that the guarantees as to consumption and illuminating power can be fulfilled. A case was recently brought to our notice where the firm guaranteed the annual consumption at 176,000 cubic feet; it actually exceeded this by only 600 cubic feet in a year's working. This instances how closely, with this type of lamp, estimates can be made of the gas consumption. From many places in London and the country, tests assure us that the nominal efficiency of 60 candles per cubic foot of gas, and sometimes over, is reached, when the prescribed conditions as to pressure, consumption, and so forth, are maintained. We can quite understand that, when the conditions are not complied with, or if there is any laxity in giving the requisite attention to the lamps, the efficiency would not be maintained. Professor Morris does not stand alone as an authority. Experience is wide in the gas industry; and it is continuous. Then as to Mr. Bradley's old tests. If we mistake not, the report to which "Engineering Correspondent" refers is dated some time since (as already said, we stand subject to correction here), and that the lamps were the predecessors of those now in use in Whitehall. Furthermore, we believe that the tests were made with a photometer which has since been discarded for one in which the defects existent in the former are not to be found. With the old photometer, the respective angles of the lamp and the standard, if we recollect rightly, could not be adjusted; and a new photometer, in which such adjustment can be made, has been adopted in the City of Westminster. Is it fair to use these figures as applying to the conditions of to-day? Let "Engineering Correspondent" reply.

The gas industry's critic, under the heading of "Metallic Filament Lamps," quotes at length from a paper, and remarks in reply to the discussion thereon, by Mr. Haydn Harrison, in which he refers to tests made of street lamps in Marylebone by Messrs. Alexander Wright and Co. Here, again, the lamps tested were not fitted with the new inverted burners that are now being extensively adopted in the streets of London, but with the old vertical type. Mr. Harrison said the results of the tests showed an average illuminating power for the single 4½ cubic feet gas mantles of 50 candles and 76·6 candles for the double mantles. "Engineering Correspondent" adopts these figures to compare with a present-day metallic filament lamp! Is this electrical justice? Is it a lapse in the promptings of a mind that scorns anything but precision, and speaks of the "English spirit?" We do not know. But let us be just, and not compare old vertical burners with metallic filament lamps, any more than new inverted lamps with carbon filament lamps. "Engineering Correspondent" quotes Mr. Harrison's statement, in the reply to the discussion on his paper, that the mantles "were exceptionally well maintained." Then to cap all criticism, the "Engineering Correspondent" points, in all the glory of italics, to the fact that the tests were made by Messrs. Alexander Wright and Co. Now in our archives, we have the report of Messrs. Alexander Wright and Co., just as, we take it, Mr. Harrison had in his, and in that report (which was made to the Marylebone *Electricity* Department) we read: "In most cases, the particular lamps tested were those selected by *your representative*. . . . We consider the results are rather below what one usually expects to find from burners of this type; and *this is obviously due to the condition of the mantles*." Now "Engineering Correspondent" will perhaps see that he adopted a wrong foundation here. We do not remember who were responsible for the maintenance of the gas-lamps in those days—the Borough Council or the Gas Company. Now if those lamps had been properly maintained, though old burners and not the modern inverted type, there would have been no reason why the maximum candle power obtained from any one lamp should not have been generally sustained. The bases of "Engineering Correspondent's" cost arguments are, to say the least, extraordinarily defective.

Mr. Farquhar's Figures.

Returning to the analysis of the costs at Ilford, "Engineering Correspondent" shows how absurd it is for a critic to rely on insufficient knowledge. He arrives at the conclusion that the gas for these high-pressure lamps is supplied at 6d. per 1000 cubic feet at the compressing-station. We will not criticize every item in his comparison. The hire and depreciation of lamps is very heavy; and seeing that Mr. Farquhar has no lamp-posts at Ilford, and that for this lighting he brought into profitable use (it would otherwise have been of no service) an old discarded gas-main that had become insufficient for ordinary purposes, the 30s. charged for hire and depreciation of posts and mains can be ruled-out and added on to the 12s. for gas—making that item £2 2s. Now supposing each 1000-candle power lamp did consume in the 800 hours 24,000 cubic feet of gas, the receipts would equal (accepting all other items in the critic's analysis as true) 1s. 9d. per 1000 cubic feet. But Mr. Farquhar (we believe him to be equally as truthful as "Engineering Correspondent" and Professor Morris) obtains approximately the efficiency guaranteed by the makers. Therefore, the consumption per 1000-candle power lamp is not far from 17 cubic feet per hour; so that the consumption per lamp per 800 hours being about 13,600 cubic feet, he is receiving rather more per 1000 cubic feet than the present cost to ordinary consumers—2s. 10d., with a reduction at Christmas next to 2s. 9d. [Since this was written a letter has been received from Mr. Farquhar, see p. 598]

But about the price of gas. Electricians will not allow that

there is any scope for differential gas prices for street lighting and such purposes as shop lighting, while electrical suppliers may charge 4d., 5d., or 6d. per unit to private consumers, and drop precipitately to 1d. per unit for street and shop purposes. What is legitimate for them is not, they say, for the gas industry. Now if electricians will take the price of gas coal, reckon a sale of (say) 12,000 cubic feet of gas to the ton under modern conditions, take the manufacturing costs per 1000 cubic feet sold, deduct the average receipts for residuals per 1000 cubic feet of gas sold, they then have the cost in the holder per 1000 cubic feet of gas sold. To supply the street lamps and such purposes as outside shop lighting, there are none of those heavy expenses that are referable to domestic supply under the heading of distribution expenses. Works' capital and distribution expenses (other than those specially applicable to domestic supply) have, per 1000 cubic feet, been pretty generally brought down to a remarkably low figure of late years; and there is not the slightest reason why gas companies should attach, to their business in street and shop lighting, expenses for which such service is not in any way responsible. Considerations of this kind ought to suffice to show that gas companies are not doing business in this connection at prices that have no justification and profit attaching. They have a more substantial defence than electrical undertakings with their 1d. per unit.

The Whitehall Figures.

Is it necessary to discuss the ridiculous computations respecting the Whitehall figures? The whole bases of the "Engineering Correspondent's" calculations are wrong, as we have already shown. Moreover, this is an *illumination contract;* and more than once critics in connection with this contract have run themselves very close to serious trouble, by alleging, in a manner that might have been detrimental to other contracts existing and prospective, all sorts of things concerning the Gaslight and Coke Company. Any "unbiassed individual who examines" "Engineering Correspondent's" figures, after what has already been said in our criticisms of his bases of calculation, will be, let us say, in the absence of a better term, a fool if he "inevitably" arrives at any opinion upon them. But with regard to the manner in which the Gaslight and Coke Company are fulfilling their obligations under their large Westminster contract, we refer "Engineering Correspondent" and other readers to the table given by us under "Calorific Power and Burner Efficiency."

Calorific Power and Burner Efficiency.

The "Engineering Correspondent" lays great stress upon the importance of calorific value in illumination, and on its uniformity. "It is indeed one of the things that has led him to form his opinions which are unfavourable to gas lighting." Calorific power, it is true, is a factor in illumination; but it has not, within fairly wide limits, such an importance as our friend has installed in his mind. Photometrically, with a gas of a given calorific power we can get 25 candles per cubic foot in a good type ordinary inverted burner; with the same calorific-power gas used, at precisely the same low pressure, in a lamp of another make, upwards of 40 candles per cubic foot can be obtained; with the same calorific-power gas used, at a high pressure (say, 54 inches at the inlet to the bunsen of the burner of a Keith lamp), readings as high as 70 candles have been obtained—all these results with the gas supplied in the large area of the Gaslight and Coke Company. Bearing these facts in mind, calorific power shrinks in importance in the matter of high efficiency illumination. When with only a change of lamp (using the same gas pressure) the illuminating efficiency per cubic foot can be nearly doubled, or with an increase of pressure can be nearly trebled, we think that our friend—who lays so much stress on being scientific, and who finds, by looking at the gas industry through the wrong end of a telescope, that science has had small part in its huge development—will see that too much can be made of his point as to calorific power in regard to illuminating efficiency. Welsbach invented the gas mantle; those labouring in the gas industry have produced the appliances that have raised the illuminating duty of the mantle from the 15 candles obtainable when the first successful mantle was made to 20 to 25 candles, to 40 to 45 candles, and to 60 to 70 candles. The appliance used and the method of its use are, in view of these things, really of greater importance than the calorific power, though we by no means decry the important part played by this. The "Engineering Correspondent" quotes those old tests (which were never properly explained) of Professor Morris. They were made in 1908. Much has happened between 1908 and now close on 1912. "'We who have been trained in scientific work,' or I who am 'an independent scientific man,' can we, or I, conscientiously accept as being up to our, or my, high principles, tests made at so remote a period as three to four years ago, and by one observer?" Observers of large experience in matters illuminating in different parts of this country and abroad have found that the claim of the makers of the Keith lamp—when gas of about 500 B.Th.U. is used, and the conditions of use are observed—to an efficiency of 60 candles per cubic foot is well sustained.

We come down to modern times. And on April 11 last we find Mr. J. W. Bradley, M.Inst.C.E., the City Engineer and Surveyor of Westminster, reporting that "the Gaslight and Coke Company had carried out in a satisfactory manner in all respects the terms of their contract for the installation of incandescent high and low pressure gas lighting in the areas of the city covered by the contract." Mr. Bradley's tests over the quarter (a winter quarter) gave the following results:—

No. of Each Type of Lamp Erected.	Description of Lamp. Candle Power Units.	Tests Made.	Average Candle Power per Lamp.	Average Excess Candle Power over Minimum.	Average Percentage over Minimum.
20	3000 H.P. gas	51	3274	274	9·13
171	1800 H.P. ,,	57	2016	216	12·0
267	300 L.P. ,,	13	361	61	23·3
969	180 L.P. ,,	15	202	22	12·2
1485	90 L.P. ,,	14	132	42	46·6

Total excess candle power over specified minimum, 142,393, which is equal to 18·8 per cent. excess.

Does "Engineering Correspondent" question the *bona fides* of Mr. Bradley as an independent tester? We advance these figures to show that, according to this independent tester, the contract candle power—high and low pressure—was more than complied with. During that quarter, according to the official tests made at the London County Council testing-stations, the average calorific power of the Gaslight and Coke Company's gas was 122·8 calories, with a maximum of 133·7, and a minimum of 116·1 calories.

In 1903, Mr. F. D. Marshall (then of Copenhagen) read before the Institution of Gas Engineers a paper, in the course of which he said: "Both Dr. Bunte and Professor Lewes have shown over and over again, as, indeed, has Dr. Colman, the writer, and many others, that the difference in calorific value of 16-candle gas (say) of 140 calories, or 573 B.Th.U., and of 11-candle gas of 115 calories, or 460 B.Th.U., has practically no influence on the light developed by the incandescent burner." The veteran Dr. Bunte, Professor Lewes, Dr. Colman, and others—all "scientifically trained"—we have an opinion, were studying these matters long before some of our illuminating friends had got more than upon the fringe, if they had got so far, of their studies of illumination.

Again, Dr. W. A. Bone, in a communication to the Institution of Gas Engineers in 1909, dropped heavily upon those who consider that the illuminating efficiency of the mantle depends on mere calorific values; and a quotation from his communication appears in a letter from "A. V. H." in the correspondence at the end of this article. Professor A. G. Vernon Harcourt has also pointed out that one of the properties of gases, besides calorific value, which affect flame temperature is their rate of combustion. "Engineering Correspondent" admits that "he is not a specialist on the subject." Those whose names are mentioned here are; and neither he nor Professor Morris, we opine, would care to set his theory up as being more worthy of acceptance than the views of such eminent scientists.

We think sufficient reasons have been advanced to show that the stating of the calorific power of the gas would not afford any criterion of the duty to be obtained per cubic foot of gas, but that the appliances and the method of use very largely determine the efficiency to be obtained per cubic foot. Flame temperature is what is required; and this is dependent on other factors besides calorific power. This, we suggest, shows one point where the "Engineering Correspondent's" "scientific training" has not been carried far enough.

Metallic Filament Lamp.

We now come to the section of our correspondent's article headed "Metal Filament Lamp." Already this has been partially criticized. It is indeed surprising that the author of the "Golden Lights" article should in 1911 be comparing the upright incandescent burner with the metallic filament lamp. Does this strike him as fair play? It is an old electrical feat that does not appeal to us as being at all dignified. There is the common electrical sneer, too. In our article of Oct. 10, we said: "Let us confine our attention to a 50-candle power inverted burner, consuming 2½ cubic feet an hour." "Engineering Correspondent" replies to this: "Mantles have performed this feat—in the testing laboratory of a gas company." Is this the argument to be expected from the trained scientific mind? What is obtained in the laboratory is realizable outside it in the case of gas lighting. From our own actual experience, and from photometrical tests, an efficiency of 50 candles for this consumption is being obtained in private houses in London to-day, with attention to the burners at prolonged intervals, and with inverted mantles that have been in use for many months. "Engineering Correspondent" shows a want of knowledge of the inverted burner; and he takes refuge behind vertical incandescent burners that had been doing duty (possibly for years) in Marylebone. Rather more than a year ago [Sept. 13, 1910, p. 706], we criticized the Marylebone costs in relation to a tender the Gaslight and Coke Company had made for Holborn [Aug. 2, 1910, p. 346]. Since then there has been a test of low-pressure inverted lamps and metallic filament lamps—this time in Holborn. The minimum power of the units specified for the test was 300 candles. The Gaslight and Coke Company put up lamps that (by the Council's own tests) closely approached the minimum—318-candle power; their electrical competitors erected lamps that gave 395 candles ["Journal," Feb. 14, 1911, p. 468]. These results were from tests taken at specified angles. But the report of the Works Committee said: "On a further test being made at equal distances along the centre of the road, the illuminating effect was found to be about equal for both forms of lighting." Said Mr. Alderman Max Clarke subsequently ["Journal," March 14, 1911, p. 785], "when the question of

testing at 20° and 50° and down the centre of the roadway was mentioned to the Electric Light Company, another set of tests was made, and plotted in a diagram, and with this the Company agreed—proving the correctness of the former tests, that down the centre of the roadway, the *gas was superior*."

These tests and those by Mr. Bradley—not tests by the Gas Company—show that it is possible, even with all the racket of street life and mutable atmospherical conditions (Mr. Bradley's tests were taken in the winter months), to maintain high illuminating efficiency with inverted gas-lamps; and easier still is it to do so in the quiet seclusion of the dwelling-house. But "Engineering Correspondent" takes the old consumption and candle powers of vertical burners in Marylebone, and compares them with metallic filament lamps. We have no sympathy with such methods. They are the refuge of the advocate with a weak case. "Engineering Correspondent" refers in his tables to 76 candles being the "maximum" power obtained with the two-burner lamps and 50 candles as the "maximum" with single-burner lamps. In Messrs. Alexander Wright and Co.'s tests, those were stated as the "average" figures—76·58 candles and 49·99 candles to be exact—the "maximum" being respectively 111·72 and 86·49 candles. Let us repeat the comment of the firm in the report: "We consider the results are rather below what one *usually expects* to find from burners of this type; and *this is obviously due to the conditions of the mantles*."

With such false bases as these for any criticism of gas lighting in 1911, the whole structure of "Engineering Correspondent's" comment on the subject of costs falls to the ground; and we are satisfied in having drawn him into making this disclosure (we take it he desires us so to take it) as to the extent of his knowledge of the subject.

We assert from our own experience, fortified by photometrical tests, of inverted gas-lamps at low pressure that a 50-candle light can be maintained year in year out with little attention, on a consumption of 2½ cubic feet of gas per hour of a calorific power—to please our friend—of about 500 B.Th.U. per cubic foot.

Using high-pressure gas with small units, here is an actual comparison made at the Watercress and Flower Girls' Christian Mission, the Crippleage, Sekforde Street, Clerkenwell, E.C., where artificial flowers are made.

On July 26, 1910, the following test was made of the whole of the electric lamps:—	
134 lamps, giving a light of 2882 candles, consumed in one hour 6·33 units of electricity, which at 4½d. per unit made the cost	2s. 4½d. per hour.
On Aug. 20, 1910, the following test was made of the whole of the high-pressure (small unit) gas-lamps:—	
57 lamps, giving a light of 7100 candles, consumed in one hour 134 cubic feet of gas, which at 2s. 9d. per 1000 cubic feet made the cost	4½d. per hour.
Add cost of gas for compressing . .	1¼d. „
	5¾d. per hour.

The above test shows that the 57 small unit high-pressure gas-lamps gave nearly three times more light than the 134 electric lamps, and at the same time cost only about one-fourth of the amount. The test is vouched for by the engineer to the mission. [Some tests referring to this installation are described in connection with some comparisons of high-pressure and flame arc costs at the end of this article.]

A Personal Experience.

We are not astonished that an Assoc.M.Inst.E.E. has a preference for electricity in the lighting of his house. Nothing can be more natural. His experience with gas lighting in a London suburban house appears to be extraordinarily bad. Our own experience with inverted gas lighting in a private house is such, the economy so great, and the comfort so good, that we have nothing whatever to complain about. Health is good; and decorations do not suffer. This is not an isolated experience. The present writer, too, has friends who live in new houses, and consume gas; and they (like the writer) give their inverted lamps the very occasional attention that these properly fitted burners require. As for maintenance, the last time that a dozen inverted mantles were purchased for the writer's house is so remote that he cannot fix the date. It would be interesting if the "Engineering Correspondent" would expose the gas company whose officials are so remiss in their duty in regard to the maintenance for which he pays, that their servants never call unless requested, and never clean out the burners, &c., when they do call. "They merely renew the mantles. He complains, but to little purpose." That accused gas company and their servants ought to be exposed in a manner as prominent, as "Engineering Correspondent" declares himself as having been guilty of the folly of paying for an unfulfilled contract. Why did he do this? The described negligence deserves loss of custom. At the same time, the whole of the paragraph under "A Personal Experience" may be considered by some unkind critics to add to the testimony of prejudice.

Causes of Progress.

"Engineering Correspondent" has a poor opinion of the scientific attainments in the gas industry. He evidently holds the view that its engineering achievements, the remarkable economies in the manufacture of gas and the treatment of residuals, and the extraordinary extension of the growth of the efficiency of its appliances have been all a matter of luck rather than of persevering work not dissociated from scientific knowledge and training. He should look into these matters seriously; and he would find how vast have been the changes in engineering achievement, how greatly has the commercial product of a ton of coal been advanced, how vastly the costs of manufacture have been reduced—all tending to one end, the supplying of a greater number of B.Th.U. to the consumer for a given price. Our friend has met Dr. Bone at the Leeds University; but we are not sure whether it is Dr. Bone or the "Engineering Correspondent" who "believes that the gas industry of this country is suffering from a negligence some fifteen or twenty years ago of scientific research." The gas industry, let "Engineering Correspondent" mark this, has doubled its gas output in the past twenty years; and the ratio of coal consumption to gas production has passed by long steps deeper into economy. The gas industry would, we admit, have done well to have earlier attached itself to systematic scientific research; but "Engineering Correspondent" who has never lived in intimate association with the gas industry, and so cannot know it as we do, must confess, after a study of the Board of Trade statistics and the industry's literature, that internally it has not done at all badly in the matter of progress. Research is going on day by day in connection with the industry, "if not in almost every engineering college" in all the large gas-works that have now, as a matter of course, in addition to their trained engineering assistants, chemist specialists in the primary and secondary products of coal carbonization and in the utilization of those products. Constructors of gas apparatus and appliances are not working by rule of-thumb. Their productions are scientifically controlled; and the Leeds University has done its part in bringing about this co-operation of the scientifically trained mind with practical applications. The "Engineering Correspondent," we fear, sets himself on a higher pedestal than the gas industry is prepared to allot him in the criticism of its affairs, when he presumes to lecture it. Among other things, he writes: "An industry with a combined capital of many millions deserves to suffer if it will do nothing to further progress by new discoveries." He uses accusatory words assertively about the industry without intimate knowledge. More could be said on the point; but we are too charitable to wish him "bitter moments."

But what is this? "Further you cannot expect progress when it is so difficult to find out what the facts actually are in connection with an industry." Every statutory gas undertaking has to make a return to the Board of Trade year by year of its financial and working figures; and these are published for a few pence to all who care to purchase. Nothing so complete as these returns, of an official character, are published in connection with the electrical industry. There is also the yearly issue of the old standard work known by all gas experts as "Field's Gas Analysis," from which costs and workings in the London, and in a number of Suburban and Provincial, undertakings are calculated with the precision so dearly loved by those of "scientific training." Truly our friend by this article has let a flood of light upon his want of knowledge of the gas industry. But there is another thing that has struck him. It is the "entire absence of authentic and scientific facts concerning the costs of lighting by gas. He attributes this largely to the (average) unscientific training of those who are connected with the gas industry." This is extremely magnanimous of him. But who made him "a judge over us?" And what are his qualifications for the position? We have not the time to search out references for him; but if he consults the files of the "Journal," he will discover much work in gas illumination by scientific men, and a mass of costs in papers by the engineers and the commercial men of the gas industry. He proffers advice—that the things that are should be remedied. Do they want remedying in any other manner than is current? An industry that, through its administration, has developed in the material way that is to be seen by the official records knows its business better than our friend. The gas industry before this advice was published was pegging away on right lines. He admits a certain bias against gas—the whole tenor of this article, and those in the "Daily Telegraph" of which complaint was made, show it. He cannot detect any scientific control in the gas industry, and therefore how can we hope to put anything before him, from the store of our simple practical natures and experiences, that can convince a man "trained in science?" If we can convince him, he will "gladly do all in his power to help and assist" the gas industry. We are afraid the gas industry will have something to do to convince our friend; and therefore the gas industry must take steps to help itself. One way in which this must be done is to see that in the Daily Press its interests are properly represented, and not damaged in the eyes of the public. We do not want to antagonize the "Engineering Correspondent" in any way whatever. But we do wish he would get off his pedestal and not judge the gas industry so harshly from the position that he occupies external to it.

We all make mistakes. "Engineering Correspondent" is not exempt from the same failing. The "Journal," he points out, as someone in the gas industry was pointing out the other day, made a "mistake" in 1886 in referring to the Welsbach mantle. What was said *then* was not a "mistake." He overlooks the word "apparently" in the quotation he makes from the "Journal." And the reference suggests that he does not know that the mantle of 1886 was a failure; and that it was subsequent to 1886 that Welsbach made the discovery that saved the lighting business of the gas industry from going over in bulk to the electrical industry.

From the time that that discovery was made, the "JOURNAL" has been its persistent advocate.

Now that we have pointed out the deficiencies of our friend's reply as a defence to his "Daily Telegraph" articles, now that we have dealt with the advice to and criticism of the gas industry as a whole—matters which are entirely outside the terms on which we accepted the conditions laid down by our new contributor—we hope, if he pursues the controversy, that the omissions from his defence or justification will be remedied. We want him to deal with all these points from the position he occupied, and the knowledge he possessed, when he wrote the articles to which the gas industry takes exception.

We trust that "Engineering Correspondent" will not think that there is a trace of discourtesy in any of the comments made in this article. If he thinks there are—we hope he does not—let us assure him that they are only prompted by the tone of the article of which he is the author, and by the uncalled-for and ignorantly made aspersions on the scientific state of the gas industry. He has, we claim, done what we expected of him—proved by his article the smallness of the knowledge he possessed on gas affairs when he wrote on "Golden Lights," and the smallness of the knowledge he possesses to-day of the internal affairs of the gas industry. He passed judgment without having any adequate evidence in his possession; and after giving that judgment circulation in a daily paper (carrying with it damage to a great national industry), he asked for the evidence that his scientifically trained mind should have suggested he ought to have had prior to delivering judgment. We cannot understand this sort of thing. His present "defence"—if such it can be truly called—is really not worthy the extended notice and space we have devoted to it. We are afraid that will be the opinion of the scientific, practical, and commercial men of the gas industry. His defence is altogether barren; and it is not a courteous one to place before the industry that was assailed through the original article.

Comparisons of Competitive Schemes of Flame Arc and High-Pressure Gas Lighting.

We have before us some comparisons of costs between high-pressure gas lighting and electric flame arcs in connection with shop lighting; but, in order that private people may not be drawn into controversy, we suppress names and localities. We hope, however, our electrical friends will give us credit for honesty and for presenting "facts," and not something drawn from the imagination. We can assure them that we are satisfied as to the authenticity of these cases; and there we must leave the particulars for their rejection or otherwise as they think fit.

The first case refers to a

Draper's Shop in London.

Electric Scheme.

Outside lighting: Five flame arc lamps of the latest type, each of a nominal candle power of 2500.

Inside lighting:	22	100	candle power	Osram lamps
	18	50	"	"
	1	32	"	"
	4	25	"	"
Total candle power outside				12,500
" " inside				3,232

The charge for these arc lamps was at the rate of 6d. per hour for the five arc lamps, which included maintaining the lamps, supplying carbons, trimming, and general attendance, also the electricity used at the rate of 1d. per unit.

In addition, there was an annual fixed charge for the arc lamps, including the hire of same, &c.

The inside lighting was quoted for per 1000 hours at	£15	12	6

And the total annual charge for the installation amounted to £127 0s. 6d., made up as follows:—

The annual *fixed* charge for inside and outside lighting, including hire of arc lamps, was	£86	8	0*
Maintenance, supplying carbons and trimming these arc lamps, including units consumed at the rate of 6d. per hour for a period of 1000 hours	25	0	0*
For the whole of the inside lighting, burning for 1000 hours	15	12	6
Total	£127	0	6

High-Pressure Gas Scheme.

Outside lighting: Ten 1000-candle power high-pressure gas-lamps.
Inside lighting: Nineteen 300-candle power high-pressure gas-fittings.

* It will be obvious that expense for electrical energy is included in both these items.

The guaranteed cost for 1000 hours' lighting for outside and inside amounted to £47 11s., with gas at 2s. 8d. per 1000 cubic feet, made up as follows:

Outside lighting for ten 1000-candle power lamps, including gas consumed in bye-passes	£28	9	4
Inside lighting for the same number of hours and bye-passes	19	1	8
Total	£47	11	0
Total candle power, outside	10,000		
" " inside	5,700		
In addition to the above charges for gas, there was estimated the cost for the current for the motor driving the gas-compressor, 1000 hours at 4d. per unit	6	13	4
Cost of maintenance of the entire plant	17	6	0
Making a total annual cost of	£71	10	4

It is to be noted that, taking the relative candle powers between the proposed electric lighting scheme and the gas, and taking the face-value of the figures as given by the electric company, the electric proposal works out at 15,732 candles, whereas the gas works out at 15,220 candles. It is pointed out, however, that the 2500 claimed for the outside arc lamps is a nominal one only; and the actual efficiency is nothing near this figure, as so much has to be taken off for the heavy opal glass that is used in the globe that is supplied with these lamps, to make them commercially adaptable for the lighting of shop fronts. In addition, it should be noted that, while the total outside candle power proposed by the electric company claimed 12,500 and the gas 10,000, the latter scheme provides for ten units as against five electric; so that the diffusion in favour of gas is immeasurably superior.

From the figures given above, high-pressure gas claimed a saving of £57 per annum.

The initial cost for electric-wiring, &c., was £68 12s. 6d., and the initial cost for the high-pressure gas plant was £100. But in the one case the customer was simply paying for what was equivalent to gas barrel, whereas in the case of the gas plant he was buying an up-to-date high-pressure gas installation, which remained his property. The saving per annum shown, more than made up for the difference between the initial costs.

These comparative figures were given in keen competition. High-pressure gas lighting won; and subsequent tests have proved that the figures for it have been amply borne out.

It should be mentioned that the electrical company charge 8d. per unit for current used by the motor on the gas-compressor. A piece of paltry spite! In consequence of this, a few low-pressure lights were put up to save running the compressor for the inside lights only, previous to lighting up outside, when, of course, the compressor would be used, and with current at the high price named. The cost of gas used for these low-pressure lights is not a big item; and it is impossible to separate it from the house and cooking supply.

A Second Draper's Shop.

The circumstances in this instance are these: The consumer—who used twelve flame arc lamps, and who installed these in place of the ordinary gas-lamps, thereby affording the local electric people an opportunity for a testimonial—after eighteen months to two years, was so disappointed with them that he *replaced* them with high-pressure gas-lamps of 1000-candle power each, and to the same number. The price of current, we understand, at the time was on the maximum demand of 6d. and 1½d. per unit. The annual cost for current used in the twelve arc lamps amounted to £60 per annum, without maintenance and renewals. [Parenthetically it may be stated that the maintenance of gas-lamps cost less than electric lamps.]

The twelve 1000-candle power high-pressure gas-lamps not only gave a much better light, but, at an annual cost of £30, showed a saving of £30 per annum.

It is to be noted with regard to this installation that high-pressure gas actually replaced the flame arc lamps, and, as a consequence, the consumer was charged a high price for the current used for the electric motor driving the gas-compressor.

A Third Example.

In this instance the proposal for gas was for thirty-six 1000-candle power lamps outside, and seven 500-candle power lamps for lobbies, making a total of 39,500-candle power. The guaranteed hourly cost for gas for these lamps was 1s. 5d. The gas in this case was at the rate of 2s. 2d. per 1000 cubic feet. The electric proposal was for twenty-nine 800-candle power lamps—in all giving a total of 23,200-candle power. The guaranteed hourly cost for the electric lighting, at 2½d. per unit, was 1s. 9d.

This showed a saving of 4d. per hour in favour of gas, with a total candle power in favour of gas of 16,300, or 70 per cent. more light than the electric.

The annual saving on 1000 hours' lighting amounted to £16 13s. 4d., in addition to which the greater number of lamps, with a greater candle power, gave a much better lighting effect than was possible with the electric scheme.

It was admitted in this instance, by the electrical people themselves, that the candle power of the electric lamps proposed would be reduced by 30 per cent. on account of the type of globe it was proposed to use.

High-pressure gas was installed.

Tests of the Installation at the Water-Cress and Flower Girls' Christian Mission Factory.

[See Cost Comparison, under heading "Metallic Filament Lamp," in the foregoing Editorial Article.]

The following is a report by the Engineer to the Mission of a special test as to consumption of gas by the whole installation

of Keith high-pressure gas-lamps (giving 7100-candle power) in this factory on Aug. 20.

	Candle Power.
There were burning seven reputed 300-c.p. lamps	= 2100
" " fifty " 100 "	= 5000
	7100

	Cubic Feet.
At the commencement of test the meter index was at	157,600, and time 8.30 p.m.
At the conclusion of test, the meter index was at	157,734, and time 9.30 p.m.
The total consumption was therefore .	134

On the same day, between one and two p.m., a ten-minute test was made in the presence of Messrs. Keith's representative who had expressed a desire to be present; and the meter reading showed 23 cubic feet of gas consumed. This would be at the hourly rate of 138 feet.

Taking the cost of gas at 2s. 9d. per 1000 feet, the cost works out at in the first case 4·45d.; in the second case 4·554d. per hour, to which must be added 1·26d. 1·26d. " for cost of gas for gas-engine ——— making total cost 5·71d. per hour 5·814d. per hour.

The makers of Osram and other metallic filament lamps claim an efficiency of 1·1 watts per candle power per hour.

Taking the same basis of light—viz., 7100-candle power—it would take 7810 watts. Therefore the same lighting basis would consume 7·81 units, which, at 3½d., amounts to 27·33d., or 2s. 3¾d., per hour.

On July 26, a test was made of the consumption of the electric lamps. The following lamps were burning for fifteen minutes:

27 reputed 16-c.p. =	432-c.p. of the old carbon type.
100 reputed 25-c.p. =	2500-c.p. of the Osram make.
7 reputed 16-c.p. =	112-c.p. of the Tantalum make.
134	3044

The consumption was 1·583 units, which is equal to 6·33 units per hour, costing at the present rate of 4½d. per unit, 2s. 4¾d. per hour, in addition to the fact that there was more than twice the light from the gas than from the electric light. The relative cost, therefore, of the gas was as 1 is to 5 (approximately).

Comparative Cost of High-Pressure Gas and Flame Arcs.

In another part of the "JOURNAL" will be found a translation of an article by Dr. Bertelsmann, on "A Comparison of High-Pressure Gas-Lamps and Flame Arc Lamps." At the conclusion of the article, the translator makes the following comment on the reference to the public lighting charges in Westminster by the "Engineering Correspondent" of the "Daily Telegraph."

The interesting comparison of the relative economy of high-pressure gas-lamps and flame arc lamps for public lighting, of which the ultimate conclusion is stated by Dr. Bertelsmann in figures corresponding with those given in Table IV. [see p. 606] is not directly applicable to the conditions of public lighting in London and other large cities in Great Britain, because the contract price for gas for public lighting in these cities is considerably lower than 2s. 10d. per 1000 cubic feet. "Engineering Correspondent" of the "Daily Telegraph," in the course of his article in last week's "JOURNAL," refers to (or rather assumes) a public contract price of 1s. 6d. per 1000 cubic feet for gas in connection with the high-pressure gas lighting in the City of Westminster. It should therefore be interesting to him, as well as to others, to have the last column of Table IV. in Dr. Bertelsmann's article recalculated on the basis of gas being supplied at 1s. 6d., instead of 2s. 10d. per 1000 cubic feet, the maintenance charges, &c., being the same for both gas-lamps and the arc lamps as those adopted by Dr. Bertelsmann from the data which he quotes. The figures so calculated for the equivalent cost of current for flame arc lighting which will enable it to compete with high-pressure gas lighting in London are shown in the table given below, in which also are included for the guidance of gas engineers and public lighting authorities the equivalent prices at which current must be supplied when the contract price of gas for public lighting is either 1s. 3d., 1s. 9d., 2s., 2s. 3d., or 2s. 6d. per 1000 cubic feet. It will be seen that in the cases of two types of flame arc lamps the maintenance charges, &c., are in excess of the whole cost of gas lighting when gas is supplied at 1s. 6d. or less per 1000 cubic feet, and leave no margin at all for the cost of current. In the most favourable conditions for flame arc lighting, current must be supplied at 0·61d. per unit to enable it to compete with gas at 1s. 6d. per 1000 cubic feet used in inverted high-pressure lamps, taking into account all working and maintenance charges for both systems of lighting. The total cost per hour for high-pressure gas lighting, with gas at 1s. 6d. per 1000 cubic feet becomes 0·009d. for an illumination of 1 lux per 100 square metres, or 0·00083d. for 1 lux per 100 square feet.

TABLE *showing the Equivalent Prices at which Current Must be Sold for Flame Arc Lighting in Order to Compete with High-Pressure Gas-Lamps, when Gas is Supplied at the Prices stated.*

Contract Price of Gas for Public Lighting per 1000 Cubic Feet	1/3	1/6	1/9	2/-	2/3	2/6
Type of Flame Arc Lamp and Current.	Equivalent Prices of Current—Per Unit.					
	d.	d.	d.	d.	d.	d.
"Excello," yellow carbons, continuous current . . .	0·41	0·61	0·81	1·04	1·22	1·44
"Excello," yellow carbons, alternating current . . .	0·09	0·32	0·54	0·79	1·00	1·25
"Excello," white carbons, continuous current* . .	[−0·12]	0·03	0·19	0·36	0·50	0·67
"Excello," white carbons, alternating current* . .	[−0·58]	[−0·43]	[−0 27]	[−0·09]	0·05	0·22
"Axis," continuous current*	[−0·29]	[−0·11]	0·07	0·27	0·44	0·64

* The minus sign of the figures in brackets indicates that in these cases redemption and maintenance charges, &c., alone, for arc lamps, exceed the whole cost of gas lighting to the extent of the amount shown in brackets for every unit of current consumed. Thus, if in these cases current were supplied for *nil*, there would still be the loss indicated incurred, in respect of the other charges, for every unit of current consumed.

Correspondence on the "Reply" by the "Engineering Correspondent" of the "Daily Telegraph."

PROTEST OF THE PRESIDENT OF THE INSTITUTION OF GAS ENGINEERS AGAINST MISREPRESENTATION.

SIR,—Without in any way wishing to interpose in the discussion now proceeding in your columns between the "Engineering Correspondent" of the "Daily Telegraph" and yourself, will you permit me a few words upon the opinion so emphatically expressed by the "Engineering Correspondent," as to the relative training and scientific knowledge of gas and electricity engineers.

The words objected to are as follows: "He sincerely believes that electrical engineers are better trained, and have more knowledge of scientific measurement than have gas engineers"—a statement which follows almost immediately upon his confession of ineligibility for membership of the Institution of Gas Engineers. Truly an admission of inability to form a correct opinion!

"Engineering Correspondent" is at great pains to impress your readers with his scientific knowledge and qualifications; but is there no confusion of terms here? If science is but truth, and to be scientific is to accept the most correct and suitable means to a given end, a closer inquiry on "Engineering Correspondent's" part would disclose the fact that the gas industry is, at the present time, a busy hive of continual advancement and improvement upon principles which can only be described as scientific, down even to the equivalent tables of costs to those appearing in the "Electrical Times."

Engineers who have the practical control of both gas and electrical undertakings have no hesitation in ascribing quite as much scientific knowledge to be essential in the conduct of gas as of electricity undertakings.

With respect to a knowledge of scientific measurement, gas engineers have now been engaged for over a century upon operations of many kinds, involving the most accurate of measurements; and they can therefore clearly claim to possess their full share of knowledge and experience in these matters.

I am afraid the closer connection of "Engineering Correspondent" with one industry than the other has distorted his views, and led him to his unjust opinion.

R. G. SHADBOLT.
President, Institution of Gas Engineers.

Grantham, Nov. 25, 1911.

MR. FARQUHAR REPLIES.

SIR,—I must say I am rather at a loss to understand "Engineering Correspondent's" Ilford figures, and how he arrives at the absurd results shown.

With regard to the cost per lamp on our high-pressure system, the figure we charge is one which suits our purpose, and our particular requirements. If these figures are worked out on quite a different basis on some other company's high-pressure system, they might be made to represent anything.

I notice that "Engineering Correspondent" refers to the depreciation of lamps and posts as being 7½ per cent.; thus only allowing thirteen to fourteen years' life for mains. I explained in my paper before the Eastern Counties' Association that the main which is now used for our high-pressure system was lying in the ground out of use, and earning no money whatever. If this main, therefore, had not been used for high-pressure, it would still be lying idle. The question of 7½ per cent. on posts is one which does not apply to our district, as the lamps are suspended over the shops; the gas-pipe forming the bracket for the lamps having a small piece of ornamental scroll work on it to give it a finish. The cost of the brackets is very small, as they are made by our fitters; and depreciation is practically *nil*.

The table of assumed costs at Ilford, as given by "Engineering Correspondent," appears to me to be very peculiar, as the writer is evidently only dealing with twelve lamps. This table, therefore, cannot be assumed to be the cost at Ilford, as the number of lamps which we have at present is 103—that is, we have added three lamps since I read my Felixstowe paper; the number in use at that time being 100.

The price which we pay for our 1000-candle power lamps complete with stirrup piece is £3 13s. 6d. net; and we have a number of lamps of this description in use. We also have a number of lamps with 1000-candle power nozzles fitted in 1500-candle power bodies; the price of these lamps being £4 18s. 3d. This, however, is optional; and we utilize this type of lamp where we consider it advantageous to lower our maintenance charges slightly, owing to the breakage of the globes being appreciably less. On our system, we have roughly about two-thirds of the lamps at the £4 18s. 3d. figure, and the other third at the £3 13s. 6d. figure—the average price, therefore, being £4 10s.

The gas consumption given by "Engineering Correspondent" as 30 cubic feet per hour is a very absurd one. I have a large meter fixed on the gas supply to our lamps; and from actual observation I have found that each lamp, taking the average, consumes about 18½ cubic feet per hour—that is to say, 18½ cubic feet per 1000-candle power. This 18½ cubic feet represents the true consumption as registered by

the meter; and there is no getting away from this figure. I am, of course, assuming that my mains are absolutely tight as far as leakage is concerned.

The lamps which we put up in the autumn of 1908 have now had three years' service, and look quite capable of doing at least another five to seven years' work, or a total service of eight to ten years. In appearance, they look quite new; and the depreciation is very small indeed up to now. As certain of these lamps may possibly require some renewals in eight years, while others will run right out to the ten years, I have based my figures on the lamps giving respectively eight, nine, and ten years' service, and have shown three sets of figures to correspond with these three periods The depreciation, as you will notice, is 13s. 9d. on eight years' life, 12s. 6d. on nine years' life, and 11s. 5d. on a life of ten years—these figures including interest.

The depreciation on the compressor, including interest, is spread over the number of lamps we have, and only amounts to 1s. 1d. per annum.

From actual figures, the maintenance of these lamps for globes and mantles costs 6s. 10d. per annum; and the attendants' time, looking after the compressor and being in attendance when it is running, together with the lamp attendant who looks after the lamps and keeps them in thorough order, amounts to 16s. 4d. per lamp per annum.

The price of our gas at the present time is 2s. 10d., which will be reduced to 2s. 9d. per 1000 cubic feet at Christmas next. The price, however, which I allow for the gas to these high-pressure lamps is 2s. 6d. per 1000 cubic feet. As there are no meters required and other incidentals, this figure is one which gives us a very good return on our gas consumption.

"Engineering Correspondent" assumes some things which are not actually the case. For instance, he states that the compressing station may be miles from the works, &c. As a matter of fact, our compressing station is right in the centre of our main; the main extending right and left from it, as you will see from the block sketch which appeared in my Eastern Counties' paper. It would have been better if "Engineering Correspondent" had dealt with Ilford figures, and not tried to mix them up with conditions which do not apply to my figures in any shape or form. He might just as well try to compare electricity at a low figure in one district, and make it applicable to electricity in another district where the conditions are not so favourable to a low-priced supply.

I might mention with regard to the main and depreciation thereon, that the main which I am using at present in the High Road has been in the ground over sixteen years, and is as good as ever; while the main in Cranbrook Road has been in since 1901, and is also in as fresh condition as when put in. You will, therefore, see that in our neighbourhood at least depreciation on mains is very small; as a matter of fact, we put the life of our mains at fifty years as a minimum figure.

I might add with regard to the depreciation, and also the life of the lamps, that at the end of eight or ten years these lamps can be renovated and made practically as good as new at a moderate cost, as there are quite a large number of parts in them which would be capable of doing a considerable number of years more work, and it might only be the outside casing and one or two minor parts that would be required.

Actual Cost of Each High-Pressure Lamp.

	£ s. d.
Lamp £4 10s., over eight years (including interest) .	13 9
Globes and mantles, per year	6 10
Maintenance, cleaning lamps, and looking after compressor	16 4
Cost of compressor, spread over number of lamps in use, over twenty years (including interest) . . .	1 1
Gas at 2s. 6d. per 1000 cubic feet	1 17 11
	£3 15 11

	£ s. d.
Lamp £4 10s., over nine years (including interest) .	12 6
Globes and mantles, per year	6 10
Maintenance, cleaning lamps, and looking after compressor	16 4
Cost of compressor, spread over number of lamps in use, over twenty years (including interest) . . .	1 1
Gas at 2s. 6d. per 1000 cubic feet	1 17 11
	£3 14 8

	£ s. d.
Lamp £4 10s., over ten years (including interest) .	11 5
Globes and mantles, per year	6 10
Maintenance, cleaning lamps, and looking after compressor	16 4
Cost of compressor, spread over number of lamps in use, over twenty years, including interest . . .	1 1
Gas at 2s. 6d. per 1000 cubic feet	1 17 11
	£3 13 7

Our charge to the consumer for these lamps (1000-candle power) is £4 per annum, less 5 per cent., or a net figure of £3 16s. per annum.

Wm. B. Farquhar,
Engineer and Manager.

Ilford Gas Company, Nov. 22, 1911.

The Woolwich Tests.

Sir,—With reference to the tests that the writer of "Some Aspects of Lighting" says he made at Woolwich, there are one or two points that occur to me which may be of some importance. One is, that "Engineering Correspondent" takes care not to state what the actual illumination was in each case at Woolwich, although he mentions that there was 10 per cent. difference between the results of the two lamps. Presumably as he does not make capital out of it, this difference would be in favour of the gas-lamps.

It would also be very interesting to learn, whether the test for illumination was made over the entire front in each case, or only opposite a lamp, as, if I am correctly informed, this would have a most important bearing on the result.

Judging from the figures, I presume that there were only four electric lamps in the 80 feet space, while, by the cost of the gas-lamps, it would appear there were more than this number distributed over the 55 feet. The only fair way in such a case would be take the illumination tests at frequent intervals along the whole length in each case, and take the average. I am certainly inclined to believe that, if this had been done, the effect would be very different.

In the past, references have been made by electricians to Professor Morris's tests of high-pressure gas-lamps. They take the precaution not to make any reference to his tests of electric lamps, which fall very far below the rated candle power of the electric lamps in question. From my own experience, Professor Morris's tests give me the impression that he was somewhat conservative in his results, and that he certainly did not over-rate his readings. This would doubtless apply to his tests of electric lamps as well.

Scotland.

Nov. 23, 1911.

[This correspondent will be interested in the section of our article headed "The Whole Truth, and Nothing but the Truth."—Ed. J.G.L.]

Sir,—In reference to the article by "Engineering Correspondent" of the "Daily Telegraphh" in your last issue, it is perhaps a most excellent thing that the point has been thus raised as to the comparative cost of gas and electricity. Probably the following figures may be of value to the "Daily Telegraph" in arriving at some fair conclusions. From a series of tests made, I obtained the following basis, which I think should be considered as unexaggerated, and quite fair both for gas and electricity.

With an electric supply at 220 volts.

Osram Lamps.

			Volts.				Per C.P.
10 c.p.	lamps,	to work at	25,	must be used	in series of	9, and take	1 watt
100	,,	,,	,,	110	,,	,,	,,	2	,,	1·07 ,,
50	,,	,,	,,	115	,,	,,	,,	2	,,	1·15 ,,

Tantalum Lamps.

45	,,	,,	,,	110	,,	,,	,,	2	,,	1·83 ,,

Ediswan Lamps.

50	,,	,,	,,	110	,,	,,	,,	2	,,	3·7 ,,
50	,,	,,	,,	220		can be used alone		,,		3·6 ,,

Upright gas-burners give 68 c.p. per 4 c. ft. of gas per hour.

*Inverted	,,	,,	60	,,	3·3 ,,	,,	,,
*High-pressure	,,	,,	40	,,	1·0 ,,	,,	,,

It is, of course, recognized that recent Osram lamps will work singly on 220 volts.

From these figures we obtain the following :—

It is interesting to remark from the following table how economical the Osram lamp is, as compared with the carbon filament.

Cost of Electricity per Unit. Pence.	Osram Lamps.			Tantalum.	Carbon Filament Lamps.	
	10 C.P. Lamps, in Series of 9, Giving 90 C.P.	100 C.P. Lamps, in Series of 2, Giving 200 C.P.	50 C.P. Lamps, in Series of 2, Giving 100 C.P.	45 C.P. Lamps, in Series of 2, Giving 90 C.P.	50 C.P. Ediswan, in Series of 2, Giving 100 C.P.	50 C.P. Lamps Alone.
1	0·09	0·214	0·115	0·165	0·370	0·18
1½	0·135	0·321	0·172	0·247	0·555	0·27
2	0·18	0·428	0·230	0·330	0·740	0·36
2½	0·225	0·535	0·287	0·412	0·925	0·45
3	0·27	0·642	0·345	0·494	1·110	0·54
3½	0·315	0·749	0·402	0·577	1·295	0·63
4	0·36	0·856	0·460	0·658	1·480	0·72
5	0·45	1·070	0·575	0·824	1·850	0·90
6	0·54	1·284	0·690	0·988	2·220	1·08

With gas at 560 B.Th.U., costing 2s. 6d. per 1000 cubic feet, for the same candle power as above.

Cost of Gas 2s. 6d. per 1000 Cubic Feet for Same Candle Powers as Above.

Type of Burner.	90-Candle Power.	200-Candle Power.	100-Candle Power.	90-Candle Power.	100-Candle Power.	50-Candle Power.
Upright .	0·158	0·353	0·176	0·158	0·176	0·088
Inverted .	0·148	0·330	0·165	0·148	0·165	0·082
High Pressure. .	0·067	0·015	0·075	0·067	0·075	0·037

From these figures, which I think you will agree are not extravagantly in favour of gas, the following table of prices has been prepared, showing at a glance the comparative cost of gas and electricity for lighting, in which we take the cost of current at 4d. per unit and gas at 2s. 6d. per 1000 cubic feet. The charge of 4d. per unit for current has purposely been fixed, so as to enable an instant calculation to

* "Engineering Correspondent" will understand there are different types of burners made; and as to those of the high-pressure form, different types are used at different pressures. It will also be noted that "Plain English" says he has adopted efficiencies that cannot be regarded as extravagant.—Ed. J.G.L.

be made of the various electrical costs, at whatever price per unit may obtain locally; and at 2s. 6d. per 1000 cubic feet for gas figures can be readily understood in the gas industry. From this table, given any desired candle power of illumination, one may readily obtain the cost, electrically, of an equal amount of light.

TABLE *showing Cost per Hour in Pence of Different Candle Powers Using Different Makes of Electric and Gas Lamps*

Candle Power to be Obtained.	Cost by Electricity, with Current at 4d. per Unit.			Cost by Gas, with Gas at 2s. 6d. per 1000 C. Ft.		
	Osram 1·1 Watts per C. P.	Tantalum 1·83 Watts per C. P.	Ediswan 3·7 Watts per C. P.	Upright Burners 68 C. P. per 4 C. Ft.	Inverted 60 C. P. per 3·3 Ft.	High Pressure 40 C. P. per C. Ft.
10	0·044	—	0·148	0·017	0·016	0·007
45	0·198	0·33	0·666	0·079	0·074	0·033
50	0·22	0·366	0·74	0·088	0·082	0·037
90	0·396	0·66	1·332	0·158	0·148	0·067
100	0·44	0·732	1·48	0·176	0·165	0·075
150	0·66	1·098	2·22	0·265	0·247	0·115
200	0·88	1·464	2·96	0·353	0·330	0·15
250	1·1	1·83	3·7	0·441	0·413	0·187
300	1·32	2·196	4·44	0·618	0·495	0·225
350	1·54	2·562	5·18	0·53	0·577	0·262
400	1·76	2·928	5·92	0·706	0·66	0·30
450	1·98	3·294	6·66	0·794	0·742	0·337
500	2·2	3·66	7·4	0·882	0·825	0·375
550	2·42	4·026	8·14	0·971	0·907	0·412
600	2·64	4·392	8·88	1·059	0·99	0·45
650	2·86	4·78	9·62	1·147	1·072	0·487
700	3·08	5·124	10·36	1·236	1·155	0·525
750	3·3	5·49	11·1	1·324	1·237	0·562
800	3·52	5·856	11·84	1·412	1·32	0·60
850	3·74	6·222	12·58	1·5	1·402	0·637
900	3·96	6·588	13 32	1·589	1·485	0·675
950	4·18	6·954	14·06	1·677	1·567	0·712
1000	4·4	7·32	14·8	1·765	1·65	0·75

With 1000 hours' consumption and 2000 candles light, obtained from flame arcs or high-pressure gas, we get the following figures:—

2000 *Candles Light.*

Electricity.

Flame arcs.
50 volts, 10 amps. = 500 watts.
Current at 3d. per unit.
Cost, 1·5d. per lamp per hour.
Cost for 1000 hours, £6 5s. for 2000 candles.

High-Pressure Gas.

Two inverted high-pressure incandescent burners, consuming 25 cubic feet per hour each, giving 40 candles per cubic foot, with gas of 560 B.Th.U. at 2s. 4d. per 1000 cubic feet.
Cost, 1·4d. per hour.
Cost for 1000 hours, £5 16s. 8d. for 2000 candles.

In both cases maintenance is excluded; and while 3d. per unit is a low price for current, 2s. 4d. per 1000 cubic feet is low for gas. The figures for maintenance of both types may be taken as follows, on the basis of the Woolwich figures quoted by the "Daily Telegraph" "Engineering Correspondent." This was evidently a four-flame arc lamp installation, each lamp of 2000-candle power.

Electricity, 2000 *Candles.*

—	Four Lamps as at Woolwich 800 Hours.	For 1000 Hours for Four Lamps.	Per Lamp per Annum of 1000 Hours.
	£ s. d.	£ s. d.	£ s. d.
Carbons	5 0 0	6 5 0	1 11 3
Labour and supervision	2 8 0	3 0 0	0 15 0
	£7 8 0	£9 5 0	£2 6 3

Gas, 2000 *Candles.*

—	One 1000-Candle Power High-Pressure Lamp Consuming 25 Cubic Feet per Hour Giving 40 Candles per Foot = 1000 Candles.		Cost for Two Lamps = 2000-Candle Power.
		s. d.	s. d.
Mantles.	12 mantles required per annum. Cost each 9d.	9 0	18 0
Labour and supervision.	24 visits (one hour per two lamps) at 6d. per hour	6 0	12 0
	Add 12½ per cent. for supervision	0 9	1 6
		15 9	£1 11 6

Thus we get £1 11s. 6d. as the cost of maintaining two high-pressure gas-lamps of 1000 candles each, as against £2 6s. 3d. for maintaining one 2000-candle power arc lamp.

Here I think there is a very ample allowance made, both for mantles and labour, in the maintenance of the gas-lamps.

In comparing the cost of gas and electricity for power purposes, we take 746 watts per electric horse power, and 17 cubic feet of 560 B.Th.U. quality gas per horse power.

The accompanying table will give the cost per I.H.P. or B.H.P. for either commodity at a glance, at various prices for current per unit and gas per 1000 cubic feet.

Comparative Cost of Electricity and Gas for Power Purposes.

Price of Electric Current per Unit.	Cost per I.H.P. Hour.	Cost per B.H.P. Hour allowing 15 Per Cent. for Conversion.	Price of Gas per 1000 Cubic Feet.	Consumption of Gas per I.H.P. Hour.	Cost of Gas per I.H.P. Hour.	Cost of Gas per B.H.P. Hour allowing 10 Per Cent. off Indicated.
d.	d.	d.		Cub. Ft.	d.	d.
¾	0·559	0·658	1/- net	17	0·204	0·226
1	0·746	0·878	1/1 ,,	,,	0·221	0.245
1½	1·119	1·316	1/2 ,,	,,	0·238	0·264
2	1·492	1·756	1/3 ,,	,,	0·255	0·283
2½	1·678	1·974	1/4 ,,	,,	6·272	0·302
2½	1·865	2·195	1/5 ,,	,,	0·289	0 321
3	2·238	2·633	1/6, less 5 %	,,	0·290	0·323
4	2·984	3·511	1/7 ,,	,,	0·307	0·341
5	3·730	4·388	..	..	..	..
6	4·476	5·266	..	..	..	..

In comparing the heating value of electric current with that of gas, we took as a basis the comparison of horse power with current.

HEATING VALUE OF ELECTRIC CURRENT.

33,000 ft. lbs. per minute = 1 H.P. = 746 watts.
1,980,000 ft. lbs. per hour = 1 H.P. hour = 746 W. hours.
2,654,200 ft. lbs. per hour = 1 unit = 1000 W. hours.
But 772 ft. lbs. = 1 B.Th.U. (Joule's mechanical equivalent of heat).

$\therefore$ 1 Unit $= \frac{2,654,200}{772} = 3438$ B.Th.U.

$\therefore$ 1 Watt hour = 3·438 B.Th.U.

Thus we get the heating value of one watt-hour to be 3·438 B.Th.U.

From one unit of electricity is obtained 3438 B.Th.U.
From 6¼ cubic feet of gas we get 3500 B.Th.U.
Thus 6¼ cubic feet of gas is equal in value for heating purposes to one unit of electricity.

6¼ cubic feet of gas at 2s. 6d. per 1000 cubic feet costs 0·187d., while one unit of electricity costs 1d., 2d., or 3d., as the case may be locally.

I give the following comparison of the cost of electrical apparatus as compared with gas, which may be of interest.

ELECTRICITY AT 1D. PER UNIT. ELECTRICAL APPARATUS.	GAS AT 2S. 6D. PER 1000 CUBIC FEET. GAS APPARATUS.
Six-pint copper kettle. Takes 1300 watts. Raises water from 58° to 212° Fahr. in 17 minutes. Cost to boil the 6 pints = 0·37d.	Ordinary iron kettle, containing 6 pints, on gas-ring, boils in 21 minutes—*i.e.*, raises water from 58° to 212° Fahr. Gas used, 3·5 feet Cost 0·105d.
Light laundry iron, weight 5 lbs. takes 350 watts. Cost per hour, 0·35d.	Gas iron, 7¾ lbs. Takes 5 cubic feet per hour at working heat. Costs 0·15d. per hour.
Electric radiator. Each large glow lamp takes 250 watts. One radiator with four lamps costs 1d. per hour. Keeps room 12 feet square moderately warm.	5-Tube kern gas-radiator. Full on takes 17½ cubic feet per hour, costing 0·525d. per hour. Half on takes 10 feet, costing 0·3d. per hour. Turned low takes 8 feet, costing 0·24d. per hour. Keeps room 12 feet square moderately warm when half on.
Small hot-plate, 4 in. by 4 in. Weight 3 lbs. Cost 0·18d. per hour. Takes 180 watts.	Small simmering burner, used for kettle. Takes 5 cubic feet per hour. Costs 0·15d. per hour.

The broad fact remains in connection with flame arc lighting that the public are beginning to appreciate that there is some little distinction as between intensity of a light and volume of a light, and that, however intense the light may be, if it has not volume it has not the carrying power that the shopkeeper desires.

The average dimension of the source of light in a 2000-candle power flame arc is about half a square inch; while the area of the source of light from two 1000-candle power high-pressure incandescent mantles is 24 times as great. It is this difference in the volume of light of low intensity that carries, and gives satisfaction to the human eye. With the intense light there is a sense of glare. With the less intense light, there is a sense of dimension, and a peculiar overcoming of shadow.

In deciding the actual candles, who is sure? Are not the errors of photometry notorious? Can two persons read exactly the same results? Do any two photometers of different makes give similar results? And is it not by a wholesale average only that we can arrive at a fair estimate of the values of the competitive lights?

Certain it is that, however carefully photometer tests are taken in the laboratory or in the street, when the lamps of both types are tuned up, it is the man in the street who decides last, and for all, which is the better light. It is perhaps through this decision of the public that high-pressure gas is now recovering much ground lost to electricity by the introduction of flame arc lamps for shop and street lighting.

Nov. 24, 1911. PLAIN ENGLISH.

SIR,—I have read with some interest and more surprise the article from the pen of the "Engineering Correspondent" of the "Daily Telegraph" in your issue of the 21st inst., and was at once led to wonder how a professional man could write so much with so little data on which to found his "views."

As the writer asks for facts and figures, it occurred to me that it might be of interest to compare some data in regard to interior lighting (schools) that was submitted to the Illuminating Engineering Society in April and May of the present year, and published in the "Illuminating Engineer" of the same dates.

The data submitted were of an exhaustive and authentic character,

and related to several forms of lighting by electricity and gas. The figures speak for themselves. Seeing they are the results of actual observations made under every-day conditions, the inference is obvious.

Class-Room Lighting.

System of Lighting.	Practical Efficiency.		Cost per 1000 Lumen-Hours.		
	Lumens per Watt.	Lumens per Cub. Ft. per Hour.	Watt-Hours.	Cub. Ft. of Gas.	Pence.
Upright incandescent gas	..	96	..	10·4	0·34
Inverted incandescent gas	..	161	..	6·2	0·20
Tungsten	4·22	..	237	..	0·71

Laboratory Lighting.

Inverted incandescent gas	..	100	..	10	0·32
Inverted electric arcs	2·4	..	417	..	1·25

School Workshop Lighting.

Inverted incandescent gas	..	118	..	8·5	0·27
Upright incandescent gas	..	75	..	13·3	0·43
Inverted electric arcs	2·7	..	370	..	1·11

In calculating the lumen value of the light, I have taken the total area of the room as the area of the working surface. Gas is taken at 2s. 7d. per 1000 cubic feet, and electricity at 3d. per unit.

65, *Lofting Road, Barnsbury, N., Nov.* 24, 1911. J. G. Clark.

[In a subsequent letter, Mr. Clark draws attention to the fact that the gas installations alluded to in the summaries are, in each case, low pressure.—Ed. J.G.L.]

Professor Morris's Tests.

Sir,—In the article entitled "Some Aspects of Lighting," by the anonymous "Engineering Correspondent" of the "Daily Telegraph," we notice that a great deal of play is made with certain tests of high-pressure lamps made by Professor Morris.

As these tests have in the past been on more than one occasion flung in the face of the gas industry by the electricians—proving to their own satisfaction the superiority of electric lighting as against high-pressure gas lighting—we, as the makers of the lamp in question, consider it high time that some explanation of the facts should be given.

At the outset, we wish it to be thoroughly understood that we believe Professor Morris carried out the tests in question in perfect good faith, and gave a correct reading of the results as he found them under the conditions which existed.

So far as we can recall them, the facts are as follows.

Shortly after the introduction in 1908 of the lamp referred to—which was designed specially for the lighting of the grounds of the Franco-British Exhibition at Shepherd's Bush, and the Scottish National Exhibition at Edinburgh, in that year—Professor Morris approached us, and asked for facilities to make some tests of it at East London College, in order to include them in a series of tests he was then carrying out with various forms of electric lamps.

We, of course, assented. and lent the necessary apparatus. But, unfortunately, at the time the inventor of the lamp (who alone had, at that period, any intimate experience of this new lamp) was on the Continent, and so was not present to see that the lamp was arranged to suit the gas used, although a representative of our firm was admittedly present at the test.

Under the circumstances, it was hardly possible for the representative—with his limited experience under strange conditions—to appreciate how the lamp would behave. Moreover, he was not told the results obtained at the time (as they had to be worked out), or possibly the conditions would have been altered, so that a result much nearer our claims would have been obtained.

The whole trouble came about owing to the very difficulty Professor Morris pointed out in his paper—viz., the difference between the gas in use at the East London College and that at our works, where our experience with the lamps, up to that time, had been gained. At the time of the test, the gas supply at our works in Holloway was nominally 16-candle power, as supplied by the Gaslight and Coke Company; whereas the gas in use at East London College was nominally 14-candle power, as supplied by the Commercial Gas Company, and (apart from its lower value) had evidently a higher specific gravity than the Gaslight and Coke Company's gas.

The result was that with the nipple in use, only 22·8 cubic feet of gas in one test, and 23·3 cubic feet in another test, was used with the poorer gas, when at least 27 cubic feet should have been used with such a gas in order to perfectly fill the mantle.

It will readily be understood by anyone familiar with the subject, that, unless this latter condition is fulfilled, the light given out may not be nearly in proportion to the amount of gas consumed; and thus the low efficiency shown by the lamp in this case did not do anything like justice to the quantity or quality of the gas used.

On eventually hearing from Professor Morris the result of the test, our representative invited him to our own test-room at Holloway. He brought his own standard with him, and tested a lamp at Holloway, with a result, as mentioned, of 1250 candles for 23·8 cubic feet on the horizontal test, without any assistance from the reflector.

While we are not satisfied that even this test gave the full efficiency of the lamp, owing to the consumption being below the proper amount—*i.e.*, 25 cubic feet—the result of 52·5 candles per foot compares very favourably with the results of 31 and 34 candles per cubic foot at East London College.

We venture to think that the "Daily Telegraph" correspondent, with his thirst for scientific accuracy, will hardly attribute the difference of efficiency entirely to the difference in calorific value, as on this basis of argument the gas in use at Holloway would have been 70 per cent. higher in calorific value than that at the East London College, which would be out of all proportion to the actual difference.

Had we appreciated at the time that these results were to be published, we should have asked Professor Morris, on the return of the inventor, to conduct another series of tests under proper conditions. But by that time we understood that the matter was closed; and as we did not anticipate any further reference being made to the tests, the matter was allowed to drop.

So much for the actual value of the tests when used as an argument by electrical exponents. But poor as the results given are, they are not even used with common fairness.

Professor Morris points out that while at East London College he obtained a mean hemispherical candle power per cubic foot of 27·5 in the one case, and 31 in the other, he obtained in our works a result of 48 M.H.C.P. per cubic foot.

Now, in all references we have seen made to these tests, while a pretence of fairness is made by taking the mean of the two tests at East London, no notice is taken of the result obtained at Holloway. And, in addition, while our electrical friends are quite pleased to take these tests by Professor Morris as gospel, they carefully refrain from quoting his tests of electric lamps made about the same time.

It must be understood that these figures thus misused for high-pressure gas-lamps were arrived at by Professor Morris in July, 1908, or 3½ years ago, and have therefore little value at the present time—more especially as the tests were made before we had gained sufficient experience of the behaviour of our lamps under conditions new to us, or had learned how to adjust them to meet such conditions.

We are quite in agreement with some of the remarks made at the time by Professor Morris in his paper, and by the correspondent of the "Daily Telegraph," as to the very real difficulties introduced by the wide variations in the quality and composition of gases supplied in different localities. But, after all, the same difficulties appear in another form in electric supplies, and with less reason; and until our electrical friends have set their own house in order, and standardized the various public supplies as to voltage, and, in the case of alternating current, as to periodicity and number of phases, they run the risk of being reminded of the old proverb as to "people who live in glass houses," &c.

Under these circumstances, it is just as unreasonable to expect an electric lamp to work efficiently—if at all—on an unsuitable supply as to expect a gas-lamp to work equally well on any supply of gas available, without being suitably adjusted.

We are quite prepared to give facilities for Professor Morris, or any other independent authority, to make tests with our high-pressure lamps, under present conditions, provided that these tests are made with a fairly *average* quality of gas or, better still, with two or three representative qualities of gas, so that an *average* result may be arrived at, and not only the *minimum;* and also provided that the same authority tests some of the most recent arc lamps, and publishes the results side by side. Then it may be possible to arrive at some accurate idea of the relative merits of the two.

Nov. 25, 1911. James Keith & Blackman Co., Limited.

Three Further Comments.

Sir,—Will you allow me space in which to make a few comments on the article from the pen of the "Engineering Correspondent" of the "Daily Telegraph." The controversy is opportune; and nothing but good to the gas industry can come of it.

All those having the best interests of the industry at heart will agree with our "candid friend" that scientific training is absolutely essential to the continued prosperity of any industry. Gas engineers do not claim a monopoly of scientific training; but they can point to the fact that every branch of this great industry—whether in the manufacture, distribution, or in the application of gas—is directed by men who have had a scientific training.

There is an enormous amount of research work of a fundamental and also of a directly practical nature being carried on in this country, both in the manufacture and in the applications of gas. If the same strides are made during the next twenty-five years that were made in the last, the gas industry will not only maintain its financial stability, but will achieve a prosperity so far undreamt of.

Science knows no nationality, and nowhere should this be realized more than in the electrical world.

It is not an uncommon occurrence for gas engineers to be present and take part in discussions at meetings of primary interest to electrical men. The "Engineering Correspondent" suggests otherwise.

In many parts of the country men qualified in mechanical, electrical, and civil engineering have turned their attention to the many applications of gas, and are carrying out researches in connection with its use for lighting, heating, and power purposes.

So far as can be judged from the article of "Engineering Correspondent" none of the dissected comparative costs of electric and gas illumination are reliable or scientific in their compilation. They are certainly misleading. So many important factors are left unenumerated in these lists of figures that one is prompted to question the conclusions drawn from them.

In the first case, the costs for lighting a frontage of 55 feet and 80 feet by gas and electricity respectively are tabulated. No mention is made of the number of arc lamps used and the candle power of the lamps. Surely for a comparison of the costs of lighting by the two systems, some figure for the total illumination for unit length of frontage must be arrived at, and the relative costs per annum obtained. It is assumed from the figures given that four flame arcs were used in the installation; but as no figures relating to the candle power of these lamps were included, it is impossible to compare the two systems on a candle power per foot basis. It is interesting to note, however, that from the costs per foot of frontage given, with a well-designed system of high-pressure gas lighting, the mean intensity of illumination would be from three to six times that obtained in the case of a system of flame arc lighting.

As to the assumed costs at Ilford, on what basis is the cost of com-

pression brought to 8s.? For a small installation, the outside cost should be no more than 2s., including all charges. The depreciation of lamps, posts, and mains is altogether overestimated.

The "Engineering Correspondent" states that one of the things that led him to form his present opinion was the variation in candle power "due to the variation in calorific value" of the gas. "Volumes are all right for filling balloons," he says, "but heat units are wanted for incandescent mantles." I thought it was *density* that counted in filling balloons; and that the composition of the gas, the aëration of the flame, the shape of the flame, the pressure of the gas, and the adjustment and quality of the mantle affected the candle power of the mantle much more than any variation in candle power likely to be obtained under normal conditions.

The majority of gas engineers, I believe, would welcome a calorific value standard.

Might I suggest that the "Engineering Correspondent," when convinced of the economic advantages of gas lighting, should explain to the readers of the "Daily Telegraph" the relative advantages of gas and electricity for "power" and for industrial heating purposes under various conditions of working. An unbiassed article on this subject would be invaluable.

E. W. SMITH.

Birmingham, Nov. 25, 1911.

SIR,—A sigh of relief must surely have escaped from the breasts of your readers as they perused the article in last week's "JOURNAL." For, like the fabled mountain's labour, all the eager anticipation and alarming mystery, so cunningly contrived by your correspondent to herald forth his effusion, are rewarded by an entirely insignificant result. As an example of modern anonymous journalism, which is the more dogmatic in assertion because insufficiently informed, and hesitates not to build up the boldest conclusions on the frailest foundation of assured fact, the article is excellent; but it is out of place in a technical journal.

For of what avail are the author's comparisons of cost, seeing they are based only on estimates formed in his own fancy? And what can we think of the candour which, comparing incandescent gas with metallic filament lamps, takes defective examples of the former—yielding two-thirds or less of the duty that can readily be obtained—to set against the best laboratory tests of the latter? That more economical illumination can be obtained from gas than electricity, under the conditions obtaining in most large towns, does not need arguing. It is sufficiently demonstrated by the experience of consumers; and not the least striking confirmation of the fact is the hesitation shown by your correspondent to instal for his own benefit the system which he so unreservedly advocates for the good of others.

In conclusion, I beg to submit that the only point in the article worthy of serious consideration, and which might well form the starting point of useful discussion, is the question whether more uniformity than at present obtains throughout the country, in the matter of the quality of gas supplied, is not attainable, so that a burner or fitting giving certain results in one place might reasonably be expected to give the same in another.

JOHN T. SHEARD.

Sheffield, Nov. 26, 1911.

SIR,—It is very difficult to criticize freely an article on "Some Aspects of Lighting," which the anonymous "Engineering Correspondent" of the "Daily Telegraph" has addressed to you, as the conditions laid down and the protection which he requires make it extremely difficult to write impersonally.

One is accustomed to see in the Press of this country at times long paragraphs which appear to be interesting matter until one comes to the end, when they are often found to be advertisements of somebody's pills or somebody's electric lamps, or theories on cooking which can only be obtainable by the aid of electricity, &c. But when one sees an article by an "Engineering Correspondent" in the columns of a great daily paper like the "Daily Telegraph," which, under the guise of reporting on the goods shown at the Electrical Exhibition at Olympia, makes assertions against the gas industry which at the present time is providing light and heat and power for the very great majority of the people of this country, it makes one rub one's eyes and wonder where the author has been hibernating of late years not to have better knowledge than he displays in his criticism, and which is very misleading to the general public. I think it unworthy of an engineer to disparage the work of those who are in charge of the gas undertakings of this country, and who, although they do not put themselves so much in evidence to the "man in the street" as the ordinary electrical engineer, yet if it comes to a question of scientific knowledge being compared, it would be found that the gas engineer has far greater general knowledge and scientific experience than that of his competitor, although he has not the necessity to show so much "side."

I think such remarks as "He (the "Engineering Correspondent") would probably have joined the gas engineers if his knowledge of elementary chemistry had made him eligible," are extremely ungenerous and misleading. The Institution of Gas Engineers comprises several grades; and he might have been eligible for one. The Institution of Electrical Engineers also has several grades; and a tradesman has only to do a little house-wiring to be admitted an associate and call himself an electrical engineer.

The "Engineering Correspondent" is probably unaware that there are a great many engineers in charge of gas undertakings who are also fully qualified to take charge of an electrical undertaking, and who are therefore capable of speaking on both sides of this subject. The particular queries in his article on which information is asked will no doubt be fully dealt with by those engineers who are concerned; but it may be pointed out that an engineer should be fully qualified to know by examination of first principles what are the real factors which govern the two illuminants in respect to candle power and light and power. Are the researches of investigators who have examined the subject from an absolutely practical and impartial view and by direct comparison to be ignored, or is the "Engineering Correspondent" ignorant of them?

He states that he has been employed to advise on questions of lighting. Therefore it makes it very difficult to understand how the trouble which he describes with regard to the gas lighting in his own house has not been remedied, as it is well known that the adjustment of an incandescent burner is a comparatively simple matter, although it must be admitted that the ordinary householder does not seem to care to take the slightest trouble with regard to this.

GAUDIFER.

Nov. 25, 1911.

CARBONIC ACID—CALORIFIC POWER AND BURNER EFFICIENCY.

SIR,—As bearing on the carbonic acid "bogey" re-exhumed by "Engineering Correspondent," the following extracts may be of interest to him. The statement he makes, that the flame of a gas-burner gives out as much carbonic acid into the air as do two adults is right, as a statement depending on the size of the burner; but to render it accurate and *scientific*, it should be qualified, which the "Engineering Correspondent," though such a stickler for scientific accuracy, does not do.

In this connection it is interesting to refer to an elaborate research into the "Hygienic Values of Gas and Electric Lighting," by A. J. Martin, M.Inst.C.E., S. Rideal, D.Sc., F.I.C., and Dr. Bertolacci, and which was published in the "Journal" of the Royal Sanitary Institute (Vol. 29, 1908).* The investigation was primarily a medical one; and the Doctor's remarks must carry weight:

> The objection which is raised on hygienic grounds to lighting by means of gas is centred on the production of carbonic acid, which it is common to describe as a poison. It is true that no man or other animal could exist in an atmosphere of carbonic acid; but an atmosphere of nitrogen or even oxygen would be equally fatal. No one, however, speaks of these gases as poisonous. In mineral water factories, the carbonic acid present in the air often reaches 300 parts per 10,000. If the proportion reaches 500 parts (5 per cent.), it induces sickness or even death; but as the air expelled from the lungs contains on an average 4·3 per cent. of carbonic acid, it is not surprising that an atmosphere approaching that yielded from the lungs should be unsuitable for human respiration. The harmlessness of carbonic acid in the largest quantities which are likely to occur is freely recognized by medical men . . . and it is now acknowledged that the ill-effects popularly attributed to this gas are actually due to entirely different causes. Why then has so much stress been laid on the amount of carbonic acid in air? It is because this gas, though innocuous in itself, is often associated with other substances of a more or less harmful nature. As a product of respiration, it is accompanied by a certain amount of organic matter more or less offensive, and even by infective material and the germs of disease. The carbonic acid from gas is necessarily sterile; and from a health point of view bears the same relation to that of respiratory origin as sterilized milk does to the unsterilized product. The importance of the distinction between the carbonic acid from gas and that of respiratory origin is clearly recognized by the Departmental Committee on Ventilation in Factories, who, while recommending a maximum limit of twelve parts carbonic acid in 10,000 in the day time, when the excess above that found in the outer air is wholly or chiefly due to respiration, allow twenty parts after dark in places "where gas or oil (but not electricity) is used for illuminating purposes." As "fifteen men were subjected on more than 500 occasions to some 6000 tests of the kind best calculated to detect any such falling off in condition as might be expected to take place under either mode of illumination," and the tests "absolutely fail to disclose any measurable difference between one mode of lighting and another, the differences found between the two lights (gas and electricity) being so small as to be absolutely devoid of any hygienic significance."

And if the "Engineering Correspondent" will also remember that the ventilation of a gas-lighted room is much more rapid than in one lighted by electricity, he will see that the carbonic acid evolved as a product of the combustion of gas will not unduly shorten his career. If, however, he is still unconvinced, he will find further information in a joint report submitted to the Corporation of Glasgow, by the Corporation Chemist, the Gas Engineer, and the Sanitary Inspector—published in the "JOURNAL" for Jan. 4, 1910. Add to this also, the testimony in the "Medical Magazine" for February, 1911, of F. S. Toogood, M.D. (Lond.), D.P.H., Medical Superintendent of the Lewisham Infirmary, "that in large and small apartments with normal ventilation, gas consumed in modern incandescent burners can be used for lighting without any detriment to health, being found, in fact, to assist ventilation by the increased circulation of the air;" and he will, I am sure, be —— still unconvinced.

As to the matter of the illuminating power of mantles being dependent on the calorific power of the gas, insomuch as to cause a difference of 450 candles in a high-pressure lamp, I may perhaps be allowed to suggest that other things beside calorific value influence the light from a mantle. These lamps are adjusted for the gas they are intended to consume, and are not supposed to wander from place to place, and still maintain their lighting power. Supposing an electric lamp was supplied at a voltage different from its rating, this, of course, would not affect the light at all. Oh, no!—That's electricity of a *definite heating* value. Therefore it must be right! Forgive illustration by *reductio ad absurdum*.

I have no desire, Mr. Editor, to encroach any further on your space, but if the "Engineering Correspondent," who cannot accept facts as to the costs of gas lighting, yet readily accepts the figures in a trade circular of electric origin, will only carefully read the literature, he perhaps will be able to agree with the following remarks made in 1909 by Professor W. A. Bone, D.Sc., Ph.D., F.R.S.

> During recent years, the opinion has been gaining ground that the illuminating efficiency of a combustible gas, used in conjunction with an incandescent mantle, is proportional to its net calorific value. . . . But on close examination this evidence is insufficient and lacking in cogency. Moreover, the belief ignores such chemical factors involved in gaseous combustion as the relative combustion intensities of different gases, and the influence of hot surfaces thereon, as well as the known complexity of even apparently simple cases of combustion. I venture to think that few chemists who have specially studied gaseous combustion would subscribe to the "calorimetric" doctrine, at least, on the strength of the evidence so far advanced in its support.

I personally have made some hundreds of mantle tests with gases of different calorific powers; but I should be sorry to go to the extent of saying calorific value *alone* is responsible for the great difference in candle power quoted by the "Engineering Correspondent." The makers of the lamp may probably have some other explanation.

A. V. H.

Nov. 25, 1911.

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* See "JOURNAL," Vol. CI., pp. 613, 686.

A COMPARISON OF HIGH-PRESSURE GAS LAMPS AND FLAME ARC LAMPS.

The first issue of the fortnightly journal "Wasser und Gas" contains an article by Dr. Bertelsmann, a member of the technical staff of the Berlin Corporation Gas Undertaking, on the inverted high-pressure gas light and its relation to the electric flame arc light. The following is an abstract translation of the article, with reproductions of the original illustrations.

After the invention of the Welsbach mantle, gas held the primary position as an illuminating agent, except that in high-power lighting electricity had for a time considerable advantage, which the discovery of the flame arc lamp helped it to retain. The invention of the inverted incandescent gas-lamp, and of upright high-pressure gas-lamps, did not enable gas to compete on equal terms with flame arc lighting, and it was not until somewhat later that the introduction of the inverted high-pressure gas-lamp restored gas to a position of superiority in respect of high-power lights. The inverted high-pressure gas-lamp affords a range of lighting power from the tiny burners of 25 candles to the street-lamps which develop, according to their size, from 1000 to 5000 candles. Moreover, the high-pressure lamps have all the convenience of electric light in that they may be controlled from a central station. Comparatively little, however, has been published hitherto respecting the equipment of inverted high-pressure gas-lamps and igniters; and the author proceeds to refer to these points, and then to give figures showing the position of the high-pressure gas-lamp relatively to the electric flame arc lamp.

The light emission from a mantle depends solely on its temperature, and, consequently, according to Lummer's law, the light evolved at a white heat increases in the ratio of the fourteenth power of the absolute temperature. Thus, a mantle which is heated, for instance, to 1800° C. absolute, and develops a light of 100 candles, will, if heated to 1900° absolute give a light of 213 candles. Thus all that is necessary in order to increase the illuminating power of the mantle is to raise the temperature of the flame by which it is heated. But flame temperature depends on two factors—viz., the heat of combustion of the gas and the heat absorption of the gases in and about the flame. The heat developed by combustion may be easily kept unchanged by keeping the gas consumption constant. The flame temperature will be higher the smaller the quantity of gases which have to be heated by the amount of heat developed; and, consequently, the highest temperature is attained when the flame is supplied with oxygen alone, and with only so much of it as is theoretically necessary for combustion.

The use of pure oxygen is, however, economically impracticable; and since air, with its burden of nitrogen, has to be used, the highest flame temperature attainable in practice is secured by burning gas with the quantity of air theoretically required for its combustion—*i.e.*, generally about five times the quantity of gas. In the ordinary bunsen flame, the injector action of the gas draws in primary air equal to about three times the volume of the gas, and the remaining oxygen required is derived, as secondary air, from the large quantities of air coming in contact with the flame, and to which the latter gives up a considerable part of its heat. The abstraction of heat from the flame may be reduced by increasing the quantity of primary air. But in order to avoid the flame striking-back in these conditions, the rate of issue of the gas must be increased by using it at higher pressure. Gas pressures of upwards of 80 inches of water are thus used. The pressure of the gas produces a great velocity of issue from the nipples, and is partly utilized in drawing in the air required for combustion.

The high-pressure gas-flame is sharply differentiated from the ordinary bunsen flame. The core of the high-pressure flame is turquoise blue in colour, stumpy, and only about a twentieth of the size of the whole flame. The size of the flame is only about one-third of that of the ordinary bunsen flame for the same quantity of gas, and hence the outer surface of the latter flame is about $4\frac{1}{2}$ times as great as that of the high-pressure flame. The heat radiated from the flame being proportional to its outer surface, is about four times as great with the high-pressure flame as with the bunsen flame. This reduction of the loss of heat is the fundamental reason of the higher temperature of high-pressure gas-flames in general. The light produced clearly shows the higher temperature of the high-pressure flame. The ordinary Welsbach burner consumes about 5·5 cubic feet of gas for a horizontal illuminating power of 100 candles, whereas the high-pressure burner gives the same light for a consumption of 3·5 cubic feet. Its efficiency is therefore about 36 per cent. higher.

If high-pressure gas is applied to an upright burner which has been simply inverted, and the primary-air openings are protected from the intrusion of products of combustion, the horizontal illuminating power is the same as with the burner when used upright. Since, however, light radiated downwards is of more practical importance than that in the horizontal plane, it is important to note that the lower hemispherical illuminating power for the upright light without a screen is 70 per cent., and for the same with a screen 90 per cent., and for the inverted light 105 per cent. of the horizontal illuminating power. The gas consumption per 100 candles lower hemispherical illuminating power is as follows: Upright lights without screen, low pressure 7·85 cubic feet, high pressure 5·06 cubic feet; upright lights with screen, low pressure 6·12 cubic feet, high pressure 3·92 cubic feet; inverted high-pressure light, 3·38 cubic feet. Thus a gain of 14 per cent. is achieved merely by the change of disposition from the upright with screen to the inverted high-pressure light.

The altered disposition gives yet another opportunity of increasing the efficiency. The gases from the flame rise upwards at a very high temperature; and as the air for combustion is drawn into the burner-tube far above the mantle, it may be drawn through suitable chambers heated by the hot gases from the flame without interfering in any way with the radiation of the light. The heating of the air supply to the burner effects a corresponding rise in the flame temperature. By this preliminary heating of the air, it has become practicable to reduce the gas consumption to not more than 1·96 cubic feet per 100 candles lower hemispherical illuminating power. Thus, the inversion of the lamp effects a gain in efficiency of 50 per cent. over the upright high-pressure burner with screen.

The manner in which the principles which have been briefly referred to are applied in the construction of lamps will be most readily understood by reference to three examples. Fig. 1 shows a three-burner inverted high-pressure lamp of the oldest type, in which, as is clear from the figure, pre-heating of the air supply is avoided. This lamp gives a light of 2700 to 4500 candles. The horizontal mouths of the burner-tubes are outside the chimney, down the exterior of which the gas supply is carried through wrought-iron pipes. The air supply is regulated by a ring between the nipple and the mouth of the burner-tube; and this part of the lamp is protected by a sheet-metal cap from the wind. The mantles are surrounded by a large glass bowl, into which is carried a gas supply for a small flame for lighting the burners. The principle on which this lamp has been constructed has been the protection of the parts of the burner as much as possible from the spent gases and the conduction of the heat of the burner-head away by means of large masses of metal.

Fig. 2 shows another type of construction in which the whole of the parts of the burner are brought inside the chimney, with the

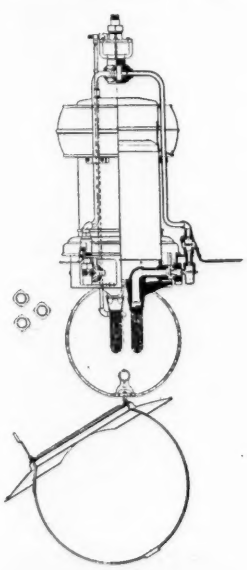


Fig. 1

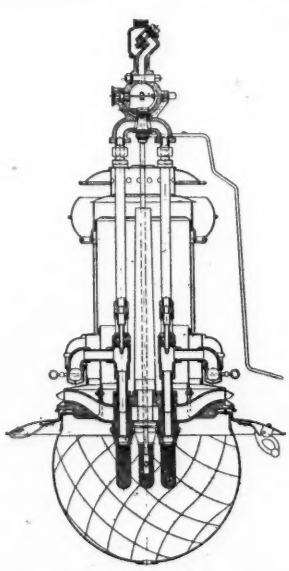


Fig. 2.

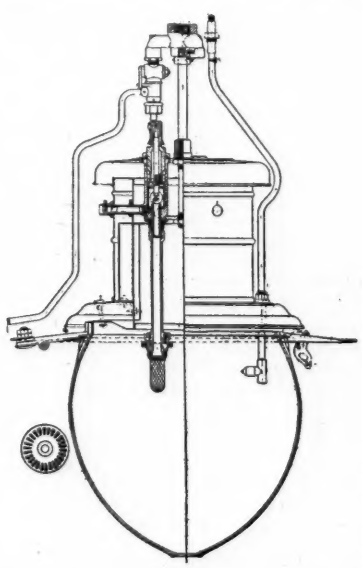


Fig. 3.

object of avoiding the angle in the burner-tubes. The primary air is introduced from outside through special tubes, and can be regulated by throttle valves. Fresh air is sucked through passages in the body of the lamp, with the object of keeping the head of the burner cool. In both these old types of construction, warming of the air or of the gas before combustion has been purposely avoided. The burner-heads are constructed of brass, and the lamps are otherwise not adapted to withstand higher flame temperatures than those attained. In the first attempts at utilizing the heat of the effluent gases, the upper parts of the burner-tubes were widened and extended so that the mixture of gas and air passing through them would be strongly heated before combustion. This method proved unsatisfactory, however, as the flames readily struck-back, and when extinguished exploded the contents of the warming chamber so violently that the mantle was destroyed.

Later on it became recognized that the best method of utilizing the heat of the effluent gases is to warm only the air required for combustion. The products of combustion pass through a corrugated metal chimney, which is surrounded with a jacket through which the air for the supply of the burners rises. Such a lamp is shown in fig. 3. It will be noticed that the burner-tubes are very long, and that the nozzles stand clear above the body of the lamp. A narrow triangular chimney surrounds the three burner-tubes, and conveys the spent gases into the head of the lamp, from which they pass into the open. The air for the supply of the burners enters the jacket of the lamp above the screen, and rises round the triangular chimney by which it is heated. It passes upwards to chambers which are fixed gas-tight round the injectors, and then passes to the burner-tubes. The jacket of the lamp is not connected with the space enclosed by the glass bowl, so that it is only through the hole in the base of the bowl that further air can reach the burners. The quantity of such air is, however, very small, owing to the small cross section of the chimney. The burner-head is made of high-melting alloys, in order to resist high temperatures. Such lamps consume not more than 1·96 cubic feet per 100 candles, and are made with one to three burners in sizes giving from 450 to 3600 candle power.

Mantles for inverted high-pressure gas lighting are not double-walled as for upright high-pressure lighting, but are single and of fairly open netting, though more heavily impregnated than the ordinary Welsbach mantles. They are attached to metal rings by asbestos filaments, the junction of which is treated with a hardening fluid; and the rings are attached to the burner by means of a bayonet catch, so that no space is left between them and the burner. The flame gases are thus compelled to pass through the mantle, instead of passing away between the ring and the mouth of the burner as in the case of the ordinary inverted gas-burner. The mantles are burned off and shaped automatically when the lamps are first lighted, so that breakage in transit has not to be reckoned with.

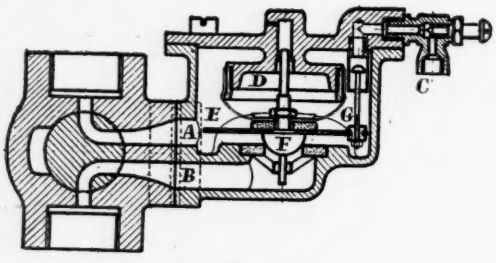


Fig. 4.

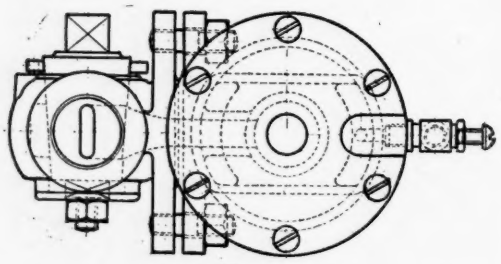


Fig. 5.

One type of distance igniter for high-pressure lamps is shown in figs. 4 and 5. The cast-iron case is attached to a two-way tap, which is connected at the top with the gas supply and at the bottom with the lamp. The gas enters through the passage A into the main chamber of the igniter, and thence passes, according to the position of the valves F and G, either through B to the burner, or through C to the pilot jet or igniting flame. The valve cones F and G are attached to a disc, which is supported by the leather diaphragm E. The latter cuts off the chamber D, which is in communication with the outer air. As long as the pressure in the main supply pipe is low, the diaphragm hangs down slack, the chief valve F is closed, the igniting jet valve G is open, and the gas can only pass through C to the latter jet. When the gas pressure is increased, the igniting jet lengthens, the diaphragm is raised, and the chief valve F is thereby opened and the burner is lighted. As soon as the full high pressure is attained, the valve G is closed and the passage of gas to the igniting jet is cut off. When the pressure begins to fall, the reverse actions occur. Ignition and extinction of the lamps consequently takes place merely by putting on or taking off the high pressure at the central station.

Although inverted high-pressure gas lighting has only been in existence for a few years, it has already fully established its reliability in use. Its good qualities and economy have already obtained for it very extensive adoption. For three years past the City of Berlin has used several thousand high-pressure inverted lamps, and lights a number of the busiest thoroughfares with them. Every year the number of these lamps is being increased. The same thing is occurring in other towns, as well as in large factories, railway yards, &c. Inverted high-pressure gas lighting is being introduced more and more for purposes for which the electric arc light would formerly have been used. This brings the author to the essential point of his paper—viz., the relation between inverted high-pressure gas lighting and the electric arc light. Opinions on this relation are divided, and, as electricians are constantly reiterating that it is more convenient and more advantageous to use electric lighting than gas lighting, the author will endeavour to draw a comparison, based as far as possible on facts, between the most advantageous forms of the two methods of lighting.

The convenience of electric lighting depends mainly on the fact that the lamps can be arranged so that they can be lowered, and can therefore be suspended at any desired height. Also they can be ignited and extinguished from a central point. Technical advances in gas lighting in recent years have, however, made it possible for gas-lamps of any kind to be suspended from brackets or transverse cables at nearly any desired height. Such installations have been in use for some years at Berlin, Stuttgart, and many other places. Ignition and extinction of the high-pressure gas-lamps are effected with complete reliability from the central station. Single lamps only have to be extinguished by hand; but this is the case also in regard to single electric lamps. As to convenience in respect of service, there is little to choose between the two methods of lighting; but it should be remembered that the replacing of mantles with the gas-lamps is not required so frequently as the provision of carbons to the arc lamps.

The economy of the two systems of lighting must naturally be judged by reference to their latest developments so far as they have been proved trustworthy in use. The author will therefore compare the high-pressure lamps with preheated air supply, which are in use at the present time, with flame arc lamps of the latest approved type. For the data relating to the gas-lamps the author depends on his own experience; and in regard to the electric lamps, on the figures published by von Heyck [Elektrotechnische Zeitschrift, 1909, p. 1081] and von Heinze [Notes of the Upper Silesian District Section of the Association of German Engineers, Nov., 1910] on the latest Excello and Axis lamps of the firm of Körting and Mathiesen.

The Excello lamps have the carbons alongside one another. Their duty is dependent on whether carbons for yellow or for white light are used; and since the difference caused thereby is very considerable, the figures for both will be included for comparison. The Axis lamps have the carbons one above the other, and there is a difference in duty according to whether there are two or three in a circuit. But as the difference is slight, the most economical method will be taken for the comparison. The working charges for both lamps differ according as continuous or alternating current is used.

The comparison of the lamps depends primarily on the illuminating power; but, as already mentioned, it is not fair to compare sources of light of different kinds on the basis of the light radiated in the horizontal or in any other one direction. The illuminating power should be determined in as many directions as possible, and the mean spherical or hemispherical illuminating power calculated therefrom. With most lamps, the differences in different directions in the vertical plane will be greater than the differences in different directions in the horizontal plane; and for the present purpose it is the vertical plane which comes into account. The author has deduced from the polar curves published by von Heyck and von Heinze the illuminating power radiated at angles increasing by 10 degrees, and for convenience has referred the figures so obtain to a mean lower hemispherical illuminating power of 4000 hefners (or 3600 candles) and compared them with the corresponding figures for a high-pressure gas-lamp of the same power. The figures obtained are shown by the author in a table, in which he gives both the actual illuminating power at the different angles between the vertical and the horizontal and the ratio of the illuminating power to the horizontal illuminating power. The actual figures, converted from hefners into English candles, are shown in Table I.

The corresponding polar curves, with the omission of the white carbon Excello lamp, are shown in the reproduction of the diagram fig. 6. The figures show that, whereas the extreme difference in the distribution of the light with the high-pressure gas-lamp is from 71·8 to 107·3 per cent. of the horizontal illuminating power, the fluctuations with the arc lamps exceed 100 per cent. The importance of the difference of distribution on the lighting value of the lamps will be realized from a comparison of the distribution of the lighting on a horizontal surface of given dimensions with the source of light at a given height. The calculation is made according to the well-known law $E = \frac{I \times \cos \alpha}{r^2}$, in which E is the intensity of illumination, I is the illuminating power, α is the angle

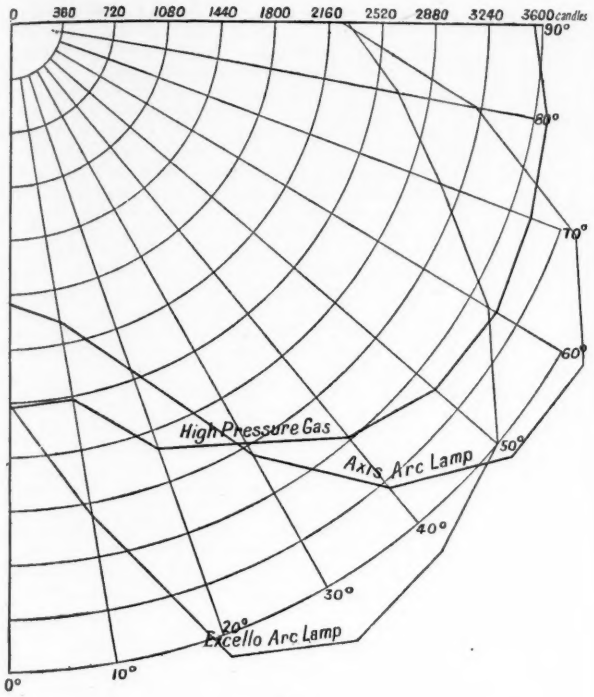


Fig. 6.

TABLE I.—*Distribution of Light from a High-Pressure Gas-Lamp and Three Types of Flame Arc Lamps on the Basis of a Mean Hemispherical Illuminating Power of 3600 Candles.*

Angle.	High-Pressure Gas.	Excello Arc Lamp.		Axis Arc Lamp.
		Yellow.	White.	
	Candles.	Candles.	Candles.	Candles.
Vertical.	2549	2538	2506	1868
10°	2542	3335	3300	2010
20°	3009	4457	4447	2454
30°	3200	4707	4604	3308
40°	3582	4559	4546	4019
50°	3763	4324	4348	4446
60°	3798	3748	3695	4481
70°	3752	3099	3162	4073
80°	3688	2656	2668	3201
Horizontal.	3540	2287	2372	2258

of incidence, and r is the distance of the illuminated spot from the source of light.

Since lamps of the powers under consideration are hung as high as possible, and large areas are illuminated by them, the author has adopted for his calculations a height for the lamps of 10 metres (nearly 33 feet) and a circular area of 50 metres (164 feet) radius. These conditions frequently occur in practice. The surface of the circle is divided by rings 2 metres (6 ft. 6 in.) apart, and the area F between adjacent rings has been calculated. Thence the mean illumination E for each annular area F has been calculated and multiplied by that area. The product is the amount of light Q expressed in lux (1 lux = the light from 1 hefner at a distance of 1 metre) for each annular area. By adding these results and dividing the sum by the total area, the mean intensity of the illumination is obtained, expressed in lux per square metre. In calculating the area of the surfaces, the author has not multiplied by π, because this figure occurs in all cases, and does not affect the comparative results.

The values obtained have been tabulated by the author. The table shows that for the high-pressure gas-lamp the maximum intensity of illumination is 27·45 lux for the ring of which the outer radius is 2 metres (1 metre = 3·28 feet), and the ring which receives the greatest quantity of light—viz., 600 lux—is that of which the outer radius is 10 metres. For the Excello arc lamp the maximum intensity of illumination is 37·25 lux for the ring of which the outer radius is 4 metres, and the maximum quantity of light—viz., 800 lux—falls in the ring of which the outer radius is 8 metres. For the Axis arc lamp, the maximum intensity of illumination—viz., 22·35 lux—is in the ring of which the outer radius is 6 metres, and the maximum quantity of light—viz., 680 lux—falls in the ring of which the outer radius is 10 metres. The intensity of illumination is lowest for all the lamps in the ring of which the outer radius is 50 metres, and is there, for the high-pressure gas-lamp 0·35 lux, for the Excello arc lamp 0·20, and for the Axis arc lamp 0·30; while the quantity of light falling in the same ring is 69 lux for the high-pressure gas, 39 lux for the Excello lamp, and 59 lux for the Axis lamp. The mean intensity of illumination for the whole surface is 2·63 lux for the high-pressure gas, 2·73 lux for the Excello arc lamp, and 2·81 lux for the Axis lamp. It follows from these figures that the difference in the distribution of light from the three lamps has no considerable effect on the average intensity of illumination, which is about 0·1 to 0·18 lux higher for the arc lamps than for the high-pressure gas-lamp. Such a difference is negligible.

The uniformity of illumination, on the other hand, is greatly affected by the description of lamp. In order to demonstrate this, the author has calculated the illumination on a line 50 metres (164 feet) in length with a lamp at each end. The amounts of light emanating from the two lamps have been added together for each point on the line, and the figures so obtained tabulated so as to show the illumination at intervals of 1 metre from the point directly below one to the point midway between the two lamps. The results have also been plotted in the diagram given in fig. 7, in which

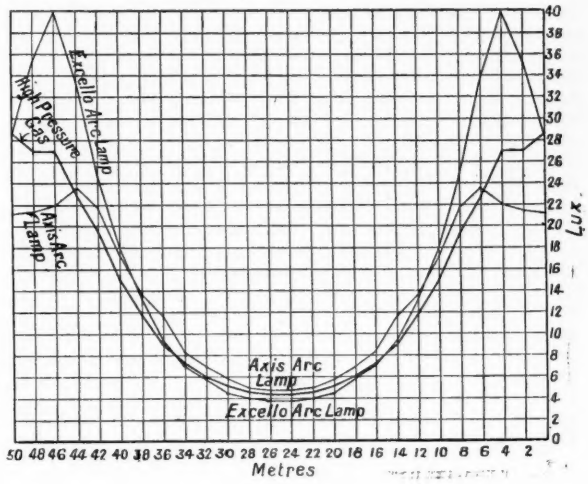


Fig. 7.

the abscissæ are the distances in metres from one of the lamps and the ordinates the intensity of illumination in lux. With the high-pressure gas, the intensity of illumination is at a maximum of 28·6 lux at the point immediately below the lamp, and at a minimum of 4·2 lux at the point midway between the lamps.

The maximum intensity of illumination for the Excello arc lamp is 39·9 lux 4 metres from the point immediately below one of the lamps; while the minimum is 3·8 lux at a point midway between the two lamps. Immediately below the lamp the illumination is 28·4 lux. For the Axis arc lamp, the maximum intensity of illumination is 23·6 lux 6 metres from the end of the line, and the minimum 4·8 lux midway between the two lamps. Immediately below the lamp the illumination is 21·1 lux. The ratio of the highest to the lowest intensity is, therefore, 6·8 for the high-pressure gas, 10·5 for the Excello, and 4·9 for the Axis arc lamp. Hence, in respect of uniformity of illumination, the Axis lamp stands first; the Excello lamp last; the high-pressure gas light taking the middle place. The relative position of the lamps in this respect, however, changes with their height, as the higher they are suspended the more advantageous are the figures for the arc lamps; and the lower they are suspended the better are the figures for the high-pressure gas. The reason therefor lies in the great difference of illuminating power near the horizontal plane.

The author, having thus demonstrated that high-pressure gas lighting and flame arc lighting are practically of equal value technically so far as illumination is concerned, passes on to the cardinal point of the working expenses of the two. These are comprised in cost of gas or current, depreciation and interest or redemption charges on the lamps, and expenses of cleaning, service, repairs, and renewal of mantles or carbons.

High-pressure gas-lamps consume per hefner-hour mean lower hemispherical illuminating power (which is that which is fully utilized for lighting purposes) about 0·5 litre of gas (or 0·0196 cubic foot per candle-hour). The gas consumption per hour of the 4000-hefner, or 3600-candle, lamps, therefore amounts to 70·6 cubic feet. This consumption is not the lowest, but an average value. The author has made many measurements in which considerably less gas, ranging down to 0·4 litre per hefner hour (0·0157 cubic foot per candle-hour), has been consumed. Since the inverted high-pressure gas-light gives over a circular area of 50 metres radius an average illumination of 2·63 lux, it follows that the gas consumption per lux per 100 square metres is 9·86 litres (0·35 cubic foot). or per lux per 100 square feet, 0·03235 cubic foot. The incidental expenses for a 4000-hefner high-pressure lamp, according to Drehschmidt's calculations [see "JOURNAL," Vol. CV., pp. 243, 311], based on figures established by the high-pressure lighting in Berlin, are, per burner-hour, as follows: For compressing gas, inclusive of redemption charges for the engines, &c., 1·4 pf., and for service and mantle renewals, &c., 2·423 pf.; or a total of 3·823 pf. Adding thereto 1·077 pf. for redemption, &c., the auxiliary charges per hour are in all 4·9 pf. Taking the cost of gas at 10 pf. per cubic metre (2s. 10d. per 1000 cubic feet), as representing a mean value between the prime cost to the undertaking and the selling price, the total cost

for a 4000-hefner lamp is made up of 20 pf. for gas and 4·9 pf. for incidental expenses, which gives a total of 24·9 pf. (3d.) per hour. This is equivalent to 0·121 pf. (0·0145d.) per lux per 100 square metres, or 0·00135d. per lux per 100 square feet.

The figures given by Heinze for the flame arc lamps are based on data for their actual lighting efficiency; and these figures have been used in compiling Table II., which shows the current consumption of the flame arc lamps.

TABLE II.—*Current Consumed by Flame Arc Lamps.*

Type of Lamp.	Consumption per Hefner-Hour.			Consumption per 4000 Hefners or 3600 Candles per Hour.		
	Continuous Current.	Alternating Current.		Continuous Current.	Alternating Current	
		With Series Resistance.	With Choking Coil.		With Series Resistance.	With Choking Coil.
	Watts.	Watts.	Watts.	Kilowatts.	Kilowatts	Kilowatts.
Excello, with yellow carbons . .	0·262	0·415	0·238	1·050	1·660	0·950
Excello, with white carbons . .	0·344	0·563	0·337	1·375	2·250	1·350
Axis . . .	0·302	0·510	0·357	1·210	2·040	1·430

The author proceeds to make his comparison on the assumption, commonly made on the Continent, that a unit of electricity is priced the same as a cubic metre of gas; and he finally states, on this basis of comparison, by how much the cost of flame arc lighting will exceed that of high-pressure gas lighting. As this method of statement is not convenient for countries where gas is not sold by the cubic metre, the author's chain of reasoning has been modified to adapt it to English conditions; the relative prices of gas and current which he has adopted having been retained—viz., 10 pf. (1·2d.) per unit of electricity, and 10 pf. per cubic metre (2s. 10d. per 1000 cubic feet) of gas. The incidental expenses—viz., cost of carbons, service, and redemption charges for the arc lamps for 4000 hefners or 3600 candles per hour—are stated in Table III. They are so high for both lamps with alternating current and series resistance and for the Axis lamp with alternating current and choking coil, that these may be excluded altogether as competitors with high-pressure gas lighting. The cost of current at 1·2d. per unit for both lamps with continuous current and for the Excello lamp with alternating current and choking coil is also shown in Table III., and, finally, the table gives the total cost of current and the incidental expenses for the same lamps.

From the figures given in Table III., the total cost of the illumination of 1 lux per 100 square metres may be deduced by dividing by the area of the circle of 50 metres radius—viz., 7854 square metres—as has already been done in the case of the high-pressure gas-lamp. The figures so obtained are shown in Table IV., in which the corresponding figure, already obtained, for the high-pressure gas-lamp is included.

Dr. Bertelsmann summarizes his general conclusions as follows: Inverted high-pressure gas lighting has been so developed and elaborated that it now fulfils all practical requirements in regard to applicability and trustworthiness in working. It has the same convenience and facility as electric light both in respect of ignition and extinction and service, and technically is equal to the latest flame arc lamps in regard to its illuminating qualities. It has the advantage over the latter that it affords an absolutely steady light. Economically, it surpasses the latest flame arc lamps to the extent indicated in Table IV.

TABLE III.—*Cost of Flame Arc Lighting for 4000 Hefners or 3600 Candles per Hour.*

Type of Lamp.	Carbons, Service, and Redemption Charges.			Cost of Current.		Total Cost of Lighting.	
	Continuous Current.	Alternating Current.		Continuous Current.	Alternating Current with Choking Coil.	Continuous Current.	Alternating Current with Choking Coil.
		With Series Resistance.	With Choking Coil.				
	d.	d.	d.	d.	d.	d.	d.
Excello, with yellow carbons .	1·29	2·52	1·62	1·26	1·14	2·55	2·76
Excello, with white carbons . .	1·89	3·84	2·52	1·65	1·62	3·54	4·14
Axis	2·13	3·38	2·94	1·45	—	3·58	—

TABLE IV.—*Comparative Cost for an Illumination of 1 Lux per 100 Square Metres and 1 Lux per 100 Square Feet for High-Pressure Gas Lighting and Electric Flame Arc Lamps.*

Type of Lamp.	Cost per Hour with Current at 1·2d. per Unit and Gas at 2s. 10d. per 1000 Cubic Feet.		Equivalent Price at which Current Must be Sold to Compete with Gas at 2s. 10d. per 1000 Cubic Feet.
	Per Lux per 100 Sq. Metres	Per Lux per 100 Sq. Feet.	
Excello, yellow carbon, continuous current	0·0119d.	0·0011d.	1·73d. per unit
Excello, yellow carbon, alternating current	0·0129d.	0·0012d.	1·56d. ,,
Excello, white carbon, continuous current	0·0165d.	0·0015d.	0·89d. ,,
Excello, white carbon, alternating current	0·0193d.	0·0018d.	0·44d. ,,
Axis, continuous current . .	0·0162d.	0·0015d.	0·39d. ,,
Inverted high-pressure gas. .	0·0145d.	0·00135d.	—

GAS REPLACES COKE AT THE ROYAL MINT.

[COMMUNICATED.]

The report of the Royal Mint for 1910, which has just been published, gives an account of the enormous operations of the department during the past year. No less than 371 tons of gold were melted in the twelve months—this amount being more than double the average of the ten years 1899 to 1908. A large quantity of nickel is melted at the Mint for coinage for East and West Africa. The gold, silver, bronze, and nickel melted during the year amounted to the prodigious total of 1251 tons; and even then the demand for coinage was so great that 250 tons of bronze blanks had to be purchased from contractors. The total number of coins struck was 158,204,241; the value of these amounting to £28,040,217, which is the highest record for the Royal Mint.

Some very important changes have been made in the methods of melting the various metals used for coinage. Preliminary experiments on the use of gas and oil instead of coke have been in progress since early in 1909; and these experiments have involved the preparation of many designs for furnaces of various sizes, and the testing of a number of burners for obtaining high temperatures—some specially designed, and others of patterns already in use in various trades. Electric furnaces were also experimented with. In connection with these trials, a number of visits were made to factories both in London and the Provinces where oil or gas was used for melting purposes; and the Superintendent was directed in January, 1910, to visit the United States and Canada, where oil is largely used, in order to collect data likely to be of assistance in arriving at a decision. Furnaces burning both petroleum and creosote oils were tested under varying conditions, and with air at pressures ranging from 2 to 25 lbs.; but it was finally decided that liquid fuel was unsuitable.

In the experiments with ordinary town gas, a number of systems were tested, involving the use of gas at ordinary and high pressures, combined with variations in the pressure of the air; and the burner ultimately adopted was made by Mr. S. N. Brayshaw, of Manchester.* For the Brayshaw burners in use at the Mint, the gas is taken at the ordinary pressure in the main (about 3 inches), and mixed with air from a powerful blowing engine at about 2 lbs. pressure. With care, the noise of these burners can be redueed sufficiently to be unobjectionable. In regard to endurance, the furnace-linings compare very favourably with those hitherto used for coke; and the crucibles used for gold are found to last longer—each crucible serving for an average of eighteen heats, as against twelve when coke is employed.

The adoption of gas as a fuel in place of coke has been accompanied by several incidental economies; and it is interesting to note that the present charge for fuel averages about 4¼d. per cwt. of standard gold bullion, as against 7d. with coke. It should be added that in this statement the fuel needed to warm up the furnace in the morning has been eliminated; but, including this, the cost rarely exceeds 5d. per cwt. on a day's work. During 1910, the Mint installed sixteen gas-heated furnaces, each capable of taking a 400 lb. crucible, and fired with Brayshaw gas-burners. These sixteen furnaces have a maximum capacity of 2¾ tons of sterling silver, or 2½ tons of bronze per melt; and four melts of silver, or three of bronze, can be made in an ordinary working day (8 a.m. to 6 p.m.). In addition, five furnaces similarly gas heated, but of a smaller size, are in use for melting gold.

Considering the large quantity of metal melted at the Mint, it will be seen that a very substantial saving in the cost of fuel alone has been effected by the use of gas. The incidental economies are, however, still greater. The cost of carting and handling both coke and clinker is saved; and the room formerly required for the storage of them is set free. The expenditure on crucibles (which is a large item) has been reduced by 33 per cent.; the work of melting is less laborious; the loss of metal is much reduced; and the bars cast are better and more uniform.

* The burner here referred to was described and illustrated in the "JOURNAL" for March 21 last, p. 852.—ED. J.G.L.

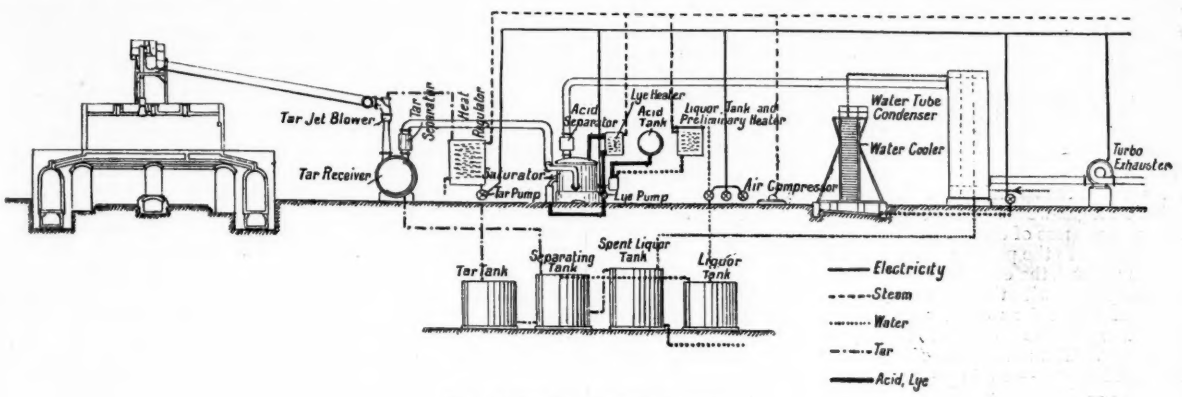
DIRECT AMMONIA RECOVERY PROCESSES.

The Otto and the Koppers Plants in Germany.

A recent number of the "Journal für Gasbeleuchtung" contained an article in which the application of direct ammonia recovery processes to gas manufacture was discussed by Dr. A. Fürth, the Chemist of the Connewitz station of the Leipzig Corporation gas undertaking. The following is a summary of the contents of the article.

The author remarks that the gap which originally subsisted between the working of coke-ovens and retorts is being filled up by the new methods of manufacture which are being adopted on gas-works. In many respects the coke-oven works are in a better position to take advantage of modern advances in the distillation of coal than municipal gas-works. With the latter, councils, committees and deputations have to be approached and votes obtained before experiments and new apparatus can be tried; whereas a short conference of the owners or board of management of the collieries can at once decide to expend thousands of pounds on new apparatus. This facility to take advantage of new methods is all to the advantage of the coke-oven works as compared with gas-works owned by public authorities (as are the majority of the gas-works in Germany). Thus, though the direct production of ammonium sulphate from crude gas has been carried out with excellent results at coke-works, gas undertakings have so far not taken up the method. The author proceeds to consider its applicability to gas-works.

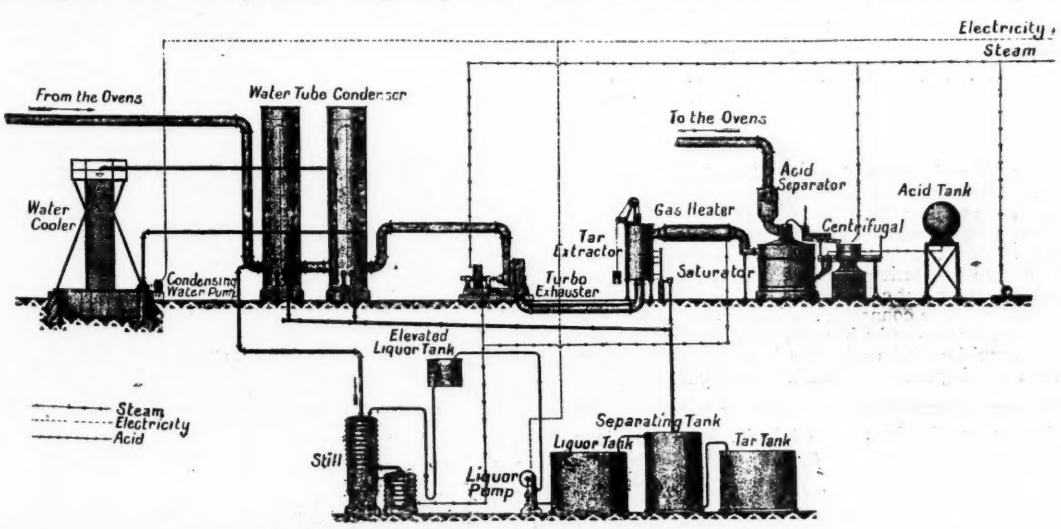
The general conditions to be observed in passing the crude gas into sulphuric acid for the recovery of sulphate are that the gas should be quite free from tar, and that the saturator should be warm enough to prevent condensation. The first condition ensures adequate purity of the salt; while observance of the second condition prevents the salt being kept in solution through the bath becoming diluted. Different inventors have taken different means to fulfil these conditions. The first man in Germany to introduce the direct sulphate process was Brunck, of Dortmund, who removed the tar from the hot gas by centrifugal action. He aimed at separating the tar while keeping the gas at a sufficiently high temperature to pass through the saturator without condensation. Nevertheless, the temperature of the gas fell low enough for condensation to occur, and raising it initially interfered with the extraction of the tar. The firm of C. Otto and Co., of Dahlhausen, used a liquor jet spray in place of the centri-



Plan of Plant for the Otto Process.

fugal tar extractor, and secured good extraction of the tar at a temperature of 80° to 100° C. (176° to 212° Fahr.). The gas was then passed through a Pelouze extractor into the saturator. On the other hand, Herr H. Koppers, of Essen, considered that good condensation was essential for the removal of the tar from the gas; and he heated the gas after condensation, by means of the sensible heat of the crude gas coming from the ovens, to a temperature of 65° to 70° C. (149° to 158° Fahr.), at which it entered the saturator. This temperature being considerably above the dew-point of the gas, dilution of the liquid in the saturator did not occur. The ammonia liberated by distillation with lime from the condensed liquor was not passed direct into the saturator, but into the crude gas from the ovens. Two of the sketches are reproduced by which our contemporary illustrated their description of the Otto and Koppers plants.

Two considerations are involved in the question as to whether any one of the direct sulphate processes can be employed in gas-works conditions—namely: (1) Can the apparatus for the direct process be introduced on gas-works without making great changes in the settings and other plant? (2) What effect is exerted by the process on the gas and the bye-products? The first must be answered independently for each type of the process. With the Otto type, the gas enters the tar separators at a high temperature (upwards of 160° C. = 320° Fahr.), so that the heat remaining in the gas is sufficient to avoid both condensation of liquor before the saturator and dilution of the liquid in the bath. On a gas-works, however, the cooling of the gas begins in the hydraulic main, and is continued in the works' main leading to the condensers, so that it would be difficult to maintain the requisite high temperature in ordinary conditions. Insulation of the main might be adopted, but would not be very trustworthy in fluctuating atmospheric temperatures. The apparatus would, therefore, have to be close to the bench of settings; and in the case of most works it would be quite impracticable to instal plant of the size required for the Otto process close to the retort-houses without making great alterations. When new works are being constructed, it would be practicable to allot space for the erection of an installation for the Otto process. In the absence of distilling plant, moreover, the gas from coals containing much chlorine would, when led directly into the saturator, liberate hydrochloric acid by the decomposition of the ammonium chloride; and this acid would corrode the metal of the saturator and of the rest of the plant, while part of the ammonium chloride retained by the tar would crystallize out from it and not be recovered. Moreover, the heat of the gas in the Otto process has not proved sufficient for the formation of salt in the saturator, and it has been found necessary to heat the



Koppers' Patent Process for the Direct Production of Sulphate.

acid in the latter. The saline solution from the saturator is circulated through a coil in a chamber heated by steam. The power required for the pumps for circulating the solution and the steam for heating make it doubtful whether there is any economy as compared with the distillation of the liquor which it displaced. The high temperature at which the gas has to be maintained further results in naphthalene being carried into the condensers which follow the saturator, and sudden cooling of the gas there causes blockages by crystals of naphthalene. The absence of tar at this stage causes the naphthalene to come down in the solid state. The author has learned of one case where an Otto plant is working on ovens carbonizing Westphalian coal, in which the condensers have to be steamed out nearly every day. Such a procedure would be out of the question in gas-works conditions. Either a naphthalene extractor would have to be installed after the saturator or the condensation would have to be carried out less suddenly, and not in a tubular condenser. These changes would involve considerable expenditure.

Retention of the distilling plant in the Koppers process renders it more trustworthy. The extraction of tar in the cold facilitates the removal of naphthalene and avoids stoppages therefrom. The tar extractor is on the pressure side of the exhauster, whereas with the Otto process it is on the suction side. The better action of the extractor in the former position is shown by the fact that whereas the crude sulphate solution in the Otto process is quite dark owing to the tar which has been carried over; that from the Koppers process is of normal colour. The sulphate obtained by the Otto process is grey; by the Koppers process, almost snow-white. The Otto process has the advantage of avoiding the production of spent liquor, tanks for which cannot conveniently be installed on the broken ground round about coal mines. Gas-works, however, are better situated in this respect; and there is no difficulty in providing a series of deep tanks or wells for the reception of the spent liquor. The existing stills of the sulphate plant on a gas-works could be readily converted for use in the Koppers process of direct sulphate recovery.

In regard to the pressure in plant with which the Koppers process is worked, the electrically-driven turbo-exhausters which are generally used with the latter admit of the pressure on the ovens being maintained as exactly as in ordinary gas-works working; and there need be no fear of sucking flue gas into the chambers or retorts. The author observed the following pressures: Before the condensers, − 18 to − 24 tenths; before the exhausters, − 24 to − 63 tenths; before the tar extractors, + 29·9 to + 41·3 inches; before the gas-heaters, + 28·7 to + 37·4 inches; before the saturators, + 28·7 to + 34·7 inches; after the saturators, + 12·2 to + 11·0 inches. The saturator is worked so that there is always 5 per cent. of free acid in the lye. Samples of the lye are taken from time to time and titrated, in order to ascertain when fresh acid should be introduced. With regular working—such as occurs on a gas-works—the inflow of the acid could be arranged at a fixed rate, so as to avoid working on Sundays and at night, thereby effecting considerable economy in wages. The labour required for the Koppers process with a make of 7 million cubic feet of gas per diem is, per shift, one engine man, one helper, one attendant for the saturator and centrifugals, and one attendant for the sulphate floor and dryer. The system covers the working of all the plant from the condensers to the purifiers, as well as the ammonia works. It should not be forgotten that the purifiers required for the ordinary sulphate process are dispensed with. The extraction of ammonia is so complete that there remains after the saturator barely 0·45 grain of ammonia per 100 cubic feet of gas. There is also an increase in the yield of tar of at least 5 per cent. If it is desired to allow a certain amount of ammonia to pass forward to the purifiers (as is sometimes done in ordinary working), this can be accomplished by the direct process—by increasing the rate of flow of the stream of gas or by providing a small bye-pass for gas from which the ammonia has not been extracted.

The author has analyzed samples which he had the opportunity of taking of the sulphate produced by the Otto and Koppers processes, with the following results:—

	Otto. Per Cent.		Koppers. Per Cent.
Ammonia	25·33	..	25·40
Free sulphuric acid	0·26	..	0·24
Ammonium chloride	1·20	..	0·09
Moisture	0·80	..	0·10

As to the quality of the gas, Schreiber has already shown that no constituents having heating or illuminating value are lost in the acid bath. Thus neither the calorific value nor the illuminating power of the gas is affected by the direct ammonia recovery process. Speaking generally, it may be said that a direct process of ammonium sulphate production is applicable to the conditions of working of gas-works, but critical examination shows that, of the two systems adopted in connection with coke-ovens, the Koppers is most suitable for gas-works, because the conversion of the gas-works plant requisite for its adoption is comparatively inexpensive, and the working of the process is in reality simpler.

The London and Southern District Junior Gas Association will next Saturday afternoon pay a visit to the works of the Gas-Meter Company, Limited, in Kingsland Road, when they will have an opportunity of seeing the factory in full work. On Friday evening, Dec. 15, Mr. S. A. Carpenter, of the North Middlesex Gas Company, will read a paper entitled "Hot Water."

SCIENCE AND CO-OPERATION IN THE GAS INDUSTRIES.

By H. James Yates, F.C.S., M.I.Mech.E.

[A Paper read before the Society of British Gas Industries, Nov. 23.]

It is a characteristic apt to be found in organizations of recent growth that they display a self-consciousness which is absent from institutions of a mellower age—such as, let us say, the Royal Society or the British Constitution. The citizen of that youngest of nations, the United States, is said to board incoming vessels even before they enter New York harbour, in order to put to some distinguished immigrant the question, "What are your impressions of America?" and to assert, without waiting for the impossible answer, "We are a great people." The Society of British Gas Industries is young enough to be excused if it should not yet have quite outgrown some such youthful interest in its own growth, and old enough to warrant some inquiry as to how far it is fulfilling, and in what ways it is likely to further fulfil, the promise of its first youth, and the pious hopes of its projectors.

At the time when the idea of such a Society was first mooted, the only branch of the great gas interest which had any corporate organization was that of gas manufacture itself, which had for so long had its regular Institution meetings for the discussion of subjects of common interest. But the gas manufacturing section of the industry, though it is a great part, is not the whole; and it was for the advantage of the industry as a whole that the other branches of manufacture included in its range—the manufacture of gas-making plant, of gas-storing plant, of gas-measuring apparatus, of apparatus for the consumption of gas for lighting, for fuel, and for power—should unite to form a body which should promote interchange of view within and between its various sections, and publicly represent their point of view with dignity and statesmanlike breadth of survey. And so, in addition to the Institution and its kindred local organizations representing gas manufacture and distribution, on the one hand, we have now, on the other, the Society of British Gas Industries, representing all the rest of the industries concerned.

When the Society came into existence, not only the industries it specially represents, but the industry as a whole, stood, as it still does, in a very high position in the engineering world; and the object of the Society is to co-operate by every means in its power to make this high position higher still. If our Society is to continue to fulfil this and the other increasingly important purposes at which it aims, it will always take a broad view of the welfare of the gas industry as a whole, and put that welfare in the forefront; and while it will seek to promote the interests of its constituents, it will do so only so long as these interests promise, on an impartial view, to subserve the ultimate advantage not of any one section, but of the industry as a whole. That it will maintain this attitude is, I believe, guaranteed by the number and variety of its membership. There are too many different interests included in it, and too many strong men among its members, to permit any one interest or view to gain undue influence. And it will be the duty of each of us, in loyalty to the Society, not to confine ourselves to the point of view of our own section, but to view the Society's concerns from the standpoint of other sections, and seek to promote their weal equally with our own. Only in this way can a society embracing so many separate industries become welded into one homogeneous body, with one common view and one common aim.

Among various matters in which the Society may exercise a helpful influence—by promoting friendly and sympathetic interchange of opinion, and in other ways such as may suggest themselves from time to time—there is one in which I am very hopeful of seeing good work done by the Society of British Gas Industries, in the cause of the industry at large. I refer to the relations between the manufacturers represented in the Society and the gasmaking side of the industry. Both the gasmaker and the gas-apparatus maker must appreciate in an increasing measure the fact that there is a common interest between them; that this common interest covers quite nine-tenths of their own individual interests; and that even in the remaining part of those interests—namely, their respective positions of buyer and seller—that common interest should always be powerful enough to make for a *modus vivendi* acceptable and profitable to both. It is not enough that the maker of gas should leave nothing undone to produce good gas and cheap, and that in quantity to meet all demands; nor that the gas distributor should second these efforts by employing every energetic and up-to-date effort in order to extend the use of gas. To the success of these labours the co-operation of the apparatus maker is a condition precedent. Indeed, in the nature of things, there is, perhaps, more scope for progress in this direction than there is room to hope for in the other. Dr. Auer von Welsbach's invention of the incandescent mantle did far more for the progress of gas than any conceivable improvement in either present-day gasmaking practice or methods of distribution propaganda could have accomplished; and the same thing might well be said of the pioneers of the gas-engine. There is much being done and yet to be done on the gasmaking side. But it is to the makers of gas apparatus, and more particularly in the spheres of lighting, fuel, and power, that the industry must chiefly look for those successive forward movements that must continue

to be made in order to maintain the position of gas against the keen competition of more than one highly-trained rival industry. This is why I venture to claim a very high position, and anticipate a very great future, for the gas industries represented in this Society.

But if gas-apparatus makers are to be in a position to do what the industry requires at their hands, there are one or two conditions which are indispensable. In the first place, they must themselves all recognize, as a number have already done, that the old easy-going days are at an end, and that in the designing of gas apparatus there must be brought to bear a full knowledge of the chemical problems arising from the composition of gas, of the scientific laws governing combustion, both in relation to economy of fuel and to the maintenance of hygienic conditions, together with the most patient and accurate methods of test, and the use of the most perfect modern machinery and methods of production. For a number of years past (in season and out of season) I have done my utmost, by precept and example, to hasten the spread of this view and practice; and I feel it is on the present occasion a duty above all others to press home the crying need for science—scientific knowledge and scientific method—in every branch of the industries with which we are connected. Although in seeking to enlarge somewhat upon this subject I may be in some instances preaching to the converted, I am sure these will be the last to deprecate the matter being earnestly pressed home.

Dealing, then, with the points I have just named, let me emphasize the importance of a knowledge of the chemical problems arising from the composition and combustion of gas. Wherever gas is consumed, for whatever purpose, in apartments in which human beings have to respire, the results of that combustion in its chemical effect upon the composition of the atmosphere must be studied, together with the closely related mechanical phenomena of air-currents and ventilation. In connection with the installation and subsequent behaviour of gas-lighting apparatus, and in problems of heating by gas, there is, in many quarters, urgent need for far less vague ideas and inexact rule-of-thumb approximations. If we are to see the vast further extensions of the employment of gas which we all desire, then gas-consuming apparatus, both in its designing and its installing, must be handled with such a well-ordered and intelligent knowledge of its effects in respect of economy and of hygienics as will cause the public to increasingly recognize that the all-round use of gas is cheap, healthy, comfortable, and convenient, and that any prejudices to the contrary belonged to an epoch and an unscientific type of apparatus fast passing into forgottenness through the advance of scientific methods. To this end the time will have to come, and come soon, when not one or two pioneer establishments as at present, but every gas-apparatus factory will have its chemical and physical laboratories equipped with modern scientific instruments of precision, its mechanical test shops and apparatus, and its chemically and technically trained staff. Accurate research work must become universal in the industry; observations and tests must be systematically made; the best laboratory apparatus in existence must be employed for indicating results; and these results must be carefully recorded, tabulated, and collated, to form the basis of future calculations. Only on the basis of such data should fresh apparatus be designed, and no such new apparatus ought to be prematurely hurried on to the market for public use, but first subjected to prolonged trial, and careful perfecting, weighed in the balance, and found not wanting. One often hears apparatus commended as being turned out in a "workmanlike manner. But gas appliances, to meet the needs of the new time, must have a great deal in them that the mere workman, or workshop foreman, or draughtsman, cannot contribute. They must be more than workmanlike; they must be scientist-like as well. In other words, the rule-of-thumb must everywhere give place to the rule-of-three, every apparatus being exactly proportioned to the requirements of its situation and its work.

It would be difficult to exaggerate the value of chemistry and research work in all branches of gas-apparatus manufacture. Without these, it is impossible to be sure of producing gas-consuming apparatus that will consume the least possible amount of gas with the greatest amount of duty, and maintain perfect hygienic conditions. Yet unless such apparatus—not some of it, but all of it—fulfils these three requirements, the value and economy of gas will be so far misrepresented to the public, and its progress seriously handicapped. I cannot too strongly urge on gas-apparatus manufacturers who are yet lagging behind the times in this respect, that they must begin to live the strenuous life, and call the chemist and the skilled research worker to their aid. Those who neglect or affect to despise such methods can only end by being hopelessly outdistanced in the race, besides being the means of injuring the interests of gas and retarding its due progress.

And here a warning note must be sounded; the adoption of scientific methods is no subject for either make-believe or half-measures. The research work that is called for to-day cannot be done by proxy. The research worker must be always on the spot; his work must be continuous and unremitting; he must devote all his faculties and time to the work; he must be in constant and familiar touch with the everyday needs, and even the fancies and prejudices of the gas-consuming public, the defects in apparatus that ordinary daily use reveals, the practical difficulties and limitations of manufacture, the behaviour of particular materials under various conditions of temperature, strain, and exposure. His staple materials—such as pig-iron, fireclay, enamels, lacquers—should be kept up to a uniform standard of quality and correct composition by frequent analysis. He must familiarize himself, by adequate tests, with the qualities of the various apparatus of different makes that appear from time to time on the market—their strong points and their defects. In other words, he must be—heart, soul, and time—a gas-apparatus maker. The best scientist in the world, if he merely dabbled in gas-apparatus manufacture, could neither do justice to himself nor to it.

But although the need of scientific knowledge and method in chemical and research work is of supreme importance and urgency, there is another direction in which the call for these same methods is very little less important—that is, the employment of such plant, machinery, and workshop practice as will ensure, first, the production of the apparatus, at the lowest price consistent with adequate quality, and, second, that every part of each apparatus will be so accurately made that any number of these shall be exactly alike, not varying appreciably in shape or size, and thus permitting replacements to be made without any of that expense and trouble of fitting which are so serious a handicap on the progress of gas. No casting in which there are holes to be drilled should ever have this done except in jigs carefully prepared for the purpose, so that the position of the holes shall not vary a hairsbreadth as between any two castings in a hundred. Unfortunately, it is far less trouble to get the tongue round the word "interchangeability" than to instal the expensive plant necessary to carry the word into practice. And so one finds the *word* interchangeability too often used, while the *thing* interchangeability is conspicuous by its absence. Interchangeability must be the real thing, not an imaginary one, if it is to effect the great economies it is fitted to do, and, in consequence, render substantial help to the development of gas. I cannot too strongly urge the importance of this on all who have not yet realized it. All such accurate and scientific methods as I have been describing, and, underlying them, a sense of grave responsibility to the industry and to the public, must in the long run not only benefit both of these wide interests, but also amply recoup the individual manufacturers themselves for their outlay and their pains.

Another point which I would respectfully commend to gas-apparatus makers is the matter of the technical education of their staffs. If the rule-of-thumb is really to yield to the rule-of-three, it is obviously of vital importance that the staffs in the various works should be taught to know the accurate methods, and to prefer them to loose and "sloppy" ways. Gas apparatus to-day has become really scientific apparatus, and the draughtsman who makes the drawings for it, and the foreman who superintends its construction, should have an intelligent knowledge of the principles on which it is designed, and the way it ought to work under different conditions. It would pay gas-apparatus manufacturers to do all in their power to encourage their staffs to study the technical side of their business, by affording facilities for such studies, and perhaps by offering prizes to their staffs for proficiency in them. This might mean a little trouble, but I believe it would be well spent.

In this connection, I cannot refrain from expressing the regret which many of us must feel that so little advantage should, as yet, have been taken of the great opportunities offered by the establishment of the Livesey Chair of Gas Engineering at Leeds University. This Chair was founded by the Gas Industry; it filled a real and great want; and the Committee were fortunate in securing a Professor of wide fame—I might well say supremacy—in his subject. That subject is *our* subject, and that Chair offers the very thing which our industry stands so greatly in need of. Yet the number availing themselves of the opportunity has hitherto been disappointingly small. I cannot too strongly urge on all connected with the gas industries the clamant need for their personal interest and effort in making the value of this provision known, and extending its usefulness. Employers would do an excellent thing for themselves by encouraging and facilitating, even at some cost, the use by their staffs of the advantages offered at Leeds. An earnest effort now to give the matter publicity and popularity, and its prestige will be so established in the industry that in time to come its results will be its own best recommendation. In competition with rival industries manned by a constant succession of engineers of first-class scientific education and technical training, it would be, indeed, a calamity if the gas industries did not rise to the height of the claims upon them in this respect, and avail themselves of the advantage which such a foundation as the Leeds Chair so admirably affords.

Having said so much regarding what is needful on the part of gas-apparatus makers to enable them to fulfil the great part to which I believe they are destined in the development of the industry, let me mention another needful condition—which is, that they ought to receive the wholehearted co-operation of gas undertakings throughout the country. I ask no indulgence whatever from gas makers to gas-apparatus makers; but I am sure that neither the letter nor the spirit of my words will be misunderstood in any quarter when I say that the relations between these two branches of the industry have hitherto been too exclusively commercial for the best interests of the industry itself. In the natural desire, on the one side, to buy in the cheapest market, and, on the other, to sell in the dearest, the ultimate advantage of the gas interest at large, in which both sides have so much at stake, is sometimes overlooked. Makers of gas apparatus have too often directed their energies to designing not the article that would best do justice to gas and popularize its use, but the one that would sell cheapest, or show most "talking points," and so

capture a contract—a course which may make for present advantage, but is bound to yield an ultimate harvest of trouble. Makers of gas, on the other hand, do not always remember that the technical knowledge and scientific methods, the need for which I have striven to emphasize, are things that cost money—indeed, very often money will hardly buy them; and if the expenditure of time and brain and cash is not to be recognized and allowed for, then obviously such efforts will languish under the discouragement, and gas will be far poorer and weaker in the struggle with its rivals than it should be or need be. It is not unreasonable to suggest that the matter of price ought not to be made the one and only criterion of comparison in those numerous cases where some of the apparatus being passed under review have scientific research and method behind them, and others are without such advantages. There is much room in these things for a reasonable spirit of give-and-take. What I rely upon, and urgently plead for, is a new standpoint, a fresh and broader outlook upon the concerns of the industry on the part of all concerned. I have tried to show there is really a common interest with which the individual interests of the various branches of the industry are inextricably bound up; that the head cannot say to the feet, "I have no need of you;" and that if one branch suffers, the others, and the industry as a whole, inevitably suffer with it. I am most anxious that each branch should be fair to the other, and so be fair to the great common interest of which all are, in some degree, the trustees.

The apparatus makers ought to spare no effort to help the gas authorities, by so equipping themselves as to be in a position to design the best possible apparatus. The gas authorities ought in turn to help the apparatus makers by encouraging their efforts to improve apparatus, and by bearing their fair share of the burdens such efforts necessarily create, in a reasonable recognition of the effect that scientific perfecting of apparatus must naturally tend to exercise upon cost.

Incidentally, I would put in this further word on behalf of gas-apparatus makers. With highly specialized apparatus such as is now called for, it is of the utmost importance to have constant conditions as regards the gas, as with fluctuating gas conditions the apparatus cannot possibly do its best. The time must come, and that before long, when means will have to be taken to ensure the three following things: Higher pressure; constant pressure; constant calorific value. I hope that our gas-making friends will take this recommendation into their very serious consideration, because they may be assured that this is rapidly becoming an absolute necessity of the new conditions under which we are having to work to-day.

Let me also suggest, for the consideration of gas authorities, the question of regarding a certain quality or class of apparatus of each kind as representing, so to speak, par value, and declining to promote or encourage the use of apparatus which fell short of this level. This is done in some cases; but if it became general, it would induce such manufacturers as might be more backward to bring their apparatus up to the necessary level of type and efficiency—a result beneficial both to them and to the industry.

Several large gas authorities have already done admirable work in public advertising; and one of the most gratifying signs of the times is the movement which has given birth to the Publicity Committee of the Institution, and the co-operation in this direction between both branches of the industry for the common behoof. It is a source of great pleasure to me that this movement should have led to the formation of the British Commercial Gas Association; and I, for one, am confident that, as time goes on, we shall all find ample cause for congratulating ourselves that our Society should have associated itself with a policy so statesmanlike, and, I venture to predict, so profitable. Then, apart from the matter of advertising, some gas authorities, realizing that, as I said a little while ago, the rule-of-thumb must yield to the rule-of-three, have already begun taking means towards educating their outdoor staffs in the technical and scientific problems that face them nowadays, when gas is being so widely applied to the heating of domestic and public buildings, to hot water, and to manufacturing purposes, and questions of the hygienics of gas lighting and heating, and the phenomena of combustion, lie right in the path of daily routine. The time has come, I venture to say, when just as apparatus makers generally will have to wake up and follow the lead of those of their number who already have faced the questions of scientific methods and training, so gas authorities all over the country will also have to face it as regards their outdoor staffs. Let the apparatus makers put forth their best efforts on the most enlightened methods; but these will be largely neutralized if the outdoor staffs of the gas authorities are not also equipped to do their part with scientific precision. The manufacture of gas is a profession which is fortunate in having men of high scientific attainments, and among the staffs of gas authorities there are men well-equipped in technical knowledge. But it is most needful that all should be enabled to reach the same high level of qualification, so that for every set of conditions the right type and size of apparatus will be installed—not put in by guesswork, but proportioned to its work by calculation, and thus fitted to do its work effectively and economically, and vindicate the claims of gas to the position which all branches of the industry alike firmly believe it is fitted not only to maintain, but to greatly advance.

The splendid work done by many gas engineers and other leading officials towards this end, cannot well be overpraised. The strong position in which they have placed the undertakings under their charge, the attention they are giving to the commercial side of their business, their steady efforts towards greatly cheapened gas, which gives so good promise of ere long succeeding, are all evidence of the very strong position gas occupies, and the far greater strength it will yet reach, in the struggle against all competition. This competition becomes more strenuous and well-equipped each day; but we shall have every reason to welcome it as the healthy and stimulating influence it ought to be, if gas authorities and gas-apparatus makers will increasingly recognize the extent and importance of the common interest which unites them, and heartily co-operate with each other for the common cause. If this be done, then of the issue of the struggle and the future of gas, I, for one, have no feeling but that of the utmost confidence.

In the successes with which gas authorities are meeting to-day, I have reason to know that many of them most willingly acknowledge the great and indispensable help afforded them by the efforts of gas-appliance makers; and in the various matters I have indicated, as well as in many others which time prevents my stopping even to name, I am very hopeful that the influence of the Society of British Gas Industries may make for the increased growth of cordial relations between the two main branches of the gas industry, the recognition by each side that the other's interest is in a real sense theirs also, the moderating of too exclusively commercial views as buyer and seller, and the wider adoption of a common view and co-operative action between them, such as will greatly further the common interest in which all of us have our life-work. If the Society does so succeed, I believe it will more than achieve the purpose with which it was brought into existence.

Discussion.

The PRESIDENT (Professor Arthur Smithells, F.R.S.) said he had been very interested in Mr. Yates's paper; but he was not competent to express an opinion on any but a small part of the subject. He (the President) looked on the gas industry with great interest. He saw its difficulties; and he might say he shared its anxieties, so far as he could sympathetically do so. He looked to its future with interest and hope; and he felt that it stood in need of all the good advice and counsel that could be given to it by writers, such as Mr. Yates in his particular walk. Mr. Yates had counselled co-operation; and he had tried to indicate how, among a body of men who could in many respects be called business rivals, there was still a region in which co-operation could take place. There were larger interests than those of pure trading; and in the promotion of these larger interests, the small differences that arose between firm and firm might be forgotten, and co-operation might be secured, without which the interests of everyone might be threatened. The members knew far more than he could know about the daily problems of the gas industry. The part of Mr. Yates's paper about which he (the President) might claim to have special knowledge related to science and manufacture. He had already, on more than one occasion, tried to give the members his views on this important subject. Indeed, in his Presidential Address to the Society, he endeavoured to indicate, as far as he could, the state of the relations between science on the one hand, and the gas industry on the other. He need only say now it was very gratifying to be present, and have a prominent representative of the industrial side express, with such cordiality, and such conviction and force, the views to which they had just listened. He need hardly say that he endorsed them most thoroughly. At this time of day, the co-operation of science and industry ought really to require no advocacy. Yet he could not help thinking that the criticism Mr. Yates had offered was really justified—that there was still, in certain quarters, some considerable reluctance to adopt, with thoroughness, the gifts that science was continually offering industry. Mr. Yates had alluded to the enterprise which was connected with the University of Leeds—the Livesey Chair, which was intended to especially promote the interests of the gas industry; and he had regretted that the response which had hitherto been made was not all that might have been hoped. He (the President) shared this regret; but he must confess that he was by no means despondent. He knew perfectly well, from past experience, that every enterprise of this kind, if it was perfectly genuine, if it was not put out under false glamour, or under false attractions, went along very slowly, and that they must be content with very general progress, and with small numbers at the beginning. The great thing was to see that the work was good. If the work was good, he was not so solicitous that the numbers should be large, because he knew that if the work they did was good, by their fruits they would be known. Nothing would succeed like the success of the first few men they turned out of the new department. There was a natural reluctance, especially prominent in the English mind, to embark upon new enterprises of this kind; and he could quite understand a number of people were holding back until they saw really what sort of product the Livesey Professorship was going to turn out. But he believed it was only a question of time; and he hoped a short time. The paper to which they had listened contained a great many topics which, he was sure, would have suggested to the minds of the members observations which they would be prepared to offer.

Mr. H. M. THORNTON said he thought Mr. Yates struck the right note; it was not often that he did not. He had certainly not only dealt with the manufacturing side of the industry to which he and they all belonged, but at the same time he did not forget to reprimand (if that were not too strong a word) the other side of the industry, with which they were also closely connected. The

maker of gas apparatus had from him words of advice, and words of encouragement. On the other hand, the gas maker had also from him recommendations to which he (Mr. Thornton) was quite sure many of them were fully alive, and many of them who were not perhaps so far advanced as others were now taking into consideration. And it would not be long before they were not only willing to take their part in advancing the industry of which they were all proud, but they would find it necessary to undertake all the progressive methods which so many companies had with advantage already undertaken. There were two matters that appealed to him (Mr. Thornton) particularly in the paper. The first was the absolute need for scientific research in all departments of the gas industry. He did not think that any of them, whatever industry they might be connected with, could doubt that the words of the author were perfectly true. Not only for the gas industry was scientific research necessary for the development of new methods of manufacture, but it was also necessary in the industry of the country at large. They all knew the argument that they could not afford to scrap plant which was out of date, or any particular line of manufacture, because it involved capital expenditure which they could not afford. This was an argument that could not for a moment hold water. If they, as English people and a country, were to advance in the same ratio of success as other countries which were scientifically dealing with methods of manufacture, and which were not afraid to spend money where it would assist in turning out goods of the highest point of quality and scientific accuracy—if they as a country, and as industries of the country, were not prepared to go the whole way, and see that their plant was up-to-date, that chemists were at the head of their various departments where they were necessary, and that the foremen connected with the works had an opportunity of learning all that had to be learned from others more capable than themselves, then he was quite convinced that, as a nation, they could not possibly succeed in the way they had done in the past. Speaking of the industry to which all present belonged, there had been one long series of rapid and progressive and important improvements in all the manufacturing branches; and he was quite certain that on the other side—gas making—there had also been an equally progressive advance. The members of the Society were all of them alive to the absolute need of still going forward—not being afraid of spending money where it would return, as they must see it would return, good profits. They must not be afraid to spend; and he was convinced that, with the co-operation to which the author had referred, and which was more advanced to-day than it was three years ago, whatever competition had to be faced, if they were all combined, there was nothing but a great future in store not only for themselves, but for the gas-making side of the industry to which they were so closely allied.

Mr. T. S. Clapham (Vice-Chairman) thought that Mr. Yates had given them in his paper matters that were of great importance, in the highest possible sense. He (Mr. Clapham) belonged to what was fondly called the "heavy section" of the Society. They had to deal with larger masses than, and with things that were not so delicate in construction as, those with which Mr. Yates and Mr. Thornton had to do. But still in their foundries, where there had not been much attention given in the past to such things as metallurgy, the composition of the sands, and the coatings of the moulds, they were now giving more consideration to these matters, and were having recourse to scientific knowledge. In his firm, they were paying particular attention now to the composition of their metals, the testings, and the strains; and from the University their President represented, his firm had had great support through the education tendered there. He believed with Professor Smithells that the work of the Livesey Chair would grow; and looking at the syllabus that had been issued, the department was not going to be left high and dry.

Mr. C. E. Brackenbury (invited by the President) remarked that it was very kind of the President to call upon him as he had done. He appreciated the distinction (if he might so call it, and he did so call it), because he was not attached to any branch, either heavy or light, of the gas industry. He could now only speak as an onlooker interested in the gas industry as a whole; and except as a former gas engineer, he had no claim to be considered a scientist. But he did fully appreciate Mr. Yates's paper, which had covered a wide field. He had put forward a number of points on which he had touched lightly, but with a broad spirit such as he understood Mr. Yates desired to see extended throughout the gas industry. He (Mr. Brackenbury) took it the paper was a plea for efficiency, not only in one branch, but in every branch; and by efficiency he understood the author meant the application of scientific principles to work, careful examination, the collection and use of data, and all that one understood by the word science. The paper was a plea for the more extensive adoption of scientific methods in all sections of the industry. That members of the Society of British Gas Industries had developed these methods was well known; and they would no doubt go on developing them. As a member of the Institution of Gas Engineers, might he be allowed to say that he had reason to know that the efforts the Society were making were thoroughly and widely appreciated by members of the Institution. The work of the Society was exceedingly welcome. He quite agreed that, in the days when he was a gas engineer, there were difficulties—the difficulties to which Mr. Yates had referred. There was want of co-operation, or what he might call the spirit of partnership, in the relationships of the gas makers and gas apparatus manufacturers. As an engineer, it was always his endeavour, when he had to deal with these relationships, to do so in the spirit of partnership—partnership between the engineer and the contractor whoever he might be. There should be a fresh and broader outlook on the concerns of the industry by all. He thought all present were in hearty agreement with this proposition; and he hoped the paper would tend in some way to facilitate co-operation between the various branches. It had always seemed to him a great pity that there had not been one broad, comprehensive organization in the gas industry, representing all branches. The time had gone by for this perhaps. But it was only through the co-operation mentioned by Mr. Yates that they might get some similar result. He hoped this would come about; and it would be interesting to have before them some lines on which it could best be accomplished.

Mr. R. B. Hodgson said, in connection with the firm he represented, they had established a really first-class laboratory, and constantly carried out experiments with gases and substances pertaining to the gas industry. Last year and the year before, they had had two of their apprentices at the Leeds University taking the course there; and one of them had successfully passed his examination as a gas engineer. The Board had also during the past twelve months presented to the works an institute in which, for the winter months, they had arranged a series of lectures, two nights per week, on subjects interesting to the apprentices. Of course, in a large works in which there was a big technical staff, everyone present would consider that this was a right thing to do. In training men in this way, they were not only giving them an education, but were helping the management to which they belonged. He mentioned what they were doing so that it might be an encouragement to other companies to pursue the same course. They found the students attended the classes regularly, and were more interested in their work, while the firm had the advantage of the education they were receiving.

Mr. Fred. J. West remarked that the author had suggested to them that there should be no narrow-minded view with regard to the various sections of the Society. One or other of the sections might say its members were not interested in standard clauses, publicity funds, or gas exhibitions. He hoped no section would say this, but that the members of every section would look upon themselves as units in a great industry, having a large and common cause. Another point mentioned was with regard to research. If any justification was needed for the author's recommendation that every firm should study this important question, it was the fact that the firms in his particular line were those who had made a speciality of research work. Last year, though he (Mr. West) felt the question was somewhat laboured, he ventured to make a few remarks with reference to the Livesey Committee. At the risk of crossing swords with the President, he could not say that he had yet arrived at the stage at which he believed that a University education was the right and proper thing for any of their sons or other youths in whom they were interested. He felt that there were many who could not afford a University education for their sons; and he did not believe it was the best possible thing for them. He considered that what they wanted to do was to effect a happy combination; and he believed the most useful direction the Livesey Chair could take was that a scheme should be arranged that would bring in a large number of their sons who were prepared to spend one or two days a week at the University. He (Mr. West) would be having the privilege of attending a meeting of the Livesey Committee next week; and he might then have some remarks to make in this direction. With regard to the Publicity Fund in connection with the British Commercial Association, he did hope that all would endeavour to look at this question of raising the contribution of £2000 from the point of view that they would ultimately all benefit from the spending of it. He believed that the spending of £10,000 or £15,000 a year in the furtherance of the interests of the gas industry would, in the long run, benefit every member of the Society.

Mr. Thos. Duxbury remarked that Mr. Yates had referred to the question of cheaper gas. He (the speaker) had been engaged elsewhere in trying, as far as he could, to see if he could not do something towards letting the gas consumers patronizing municipal undertakings have the benefit of the profits, instead of allowing them to be absorbed in the rates of the town. He was on the Darwen Council, and they had falling due this next year nearly £2000 on the gas-works which they had less to pay annually in sinking fund and interest, having provided sufficient sinking fund for it. This would reduce the price 6d. per 1000 cubic feet. By selling gas cheaper, there was a bigger opening for gas heating apparatus; and the town itself would be improved by having less smoke. By this, all would benefit. The difficulty was to persuade members of town councils to keep the expenditure of their various departments within the limits of their rates. They did not like to increase the rates. In this particular case, he was trying, but he did not know how far he should succeed, to get the Local Government Board into line with the various Parliamentary Committees. They knew that Parliamentary Committees were not now granting powers so readily as they had done in the past to municipal authorities to bleed the gas consumers. On this account the Salford Bill was withdrawn two years ago; and Oldham had had to submit to a reduction and limitation of the profits they were allowed to take. Others were in the same case. This being so, in his own town, instead of going to Parliament direct for a Bill, the Council were going to apply to the Local Government Board for borrowing powers. He (Mr. Duxbury) had got into touch with the Board, and had

suggested to them that they ought to take the same stand as the Parliamentary Committees, and prohibit the gas profits going to the rates. He thought this question ought to be made one of the planks in the platform of the Society, with the view of having this profit appropriation stopped whenever the Local Government Board were asked for more borrowing powers. This was one phase of the cheaper gas question. He was sure that if 6d. or 9d. could be taken off the price of gas in the different towns of the country, it would enhance the whole industry very much indeed. This was not an impossible sum in the case of many municipal gas undertakings. He knew of one case where 11d. per 1000 cubic feet was granted to the rates; and there were quite a number at 6d. and 7d. There was the case of Barry. There the Barry Docks and Railway Company (who were the biggest property owners in the place) benefited last year to the extent of £2700 out of the gas consumers; and yet they generated their own electricity. He (Mr. Duxbury) held that this was wrong; and they ought to do something to try to rectify it.

Mr. F. Templer Depree moved a hearty vote of thanks to Mr. Yates for his admirable paper. There was only one point he would like to touch upon. That was where Mr. Yates was a little bit doubtful as to the progress of the Livesey Chair at the Leeds University. Many of the members had the opportunity, as he (Mr. Depree) had, of listening to one of the best addresses he ever heard. It was by their present President; and he made use of the remark at the time that, in connection with University training, it was not possible to put forward a debtor and creditor account. This phrase of Professor Smithells had stuck in his memory; and it was one of the truest they could possibly apply to a question of such a big nature as the Livesey Chair. They could not expect to see any immediate result from it; it was only by time that such work could show its effect in industry. They were, however, going in the right direction when making special effort on behalf of the industry to bring science to bear upon it, so that they might benefit in the future. It was as well perhaps that the Leeds University should be kept up to the mark. [Laughter.] Mr. West had said that they might not wish to give their sons a University education. In his (Mr. Depree's) opinion, a University education was, so far as their industry was concerned, of vital importance.

Mr. W. D. Helps seconded the motion. In doing so, he said the paper took him back to about 1875 or 1876 when he was connected with a gas company which was one of the pioneers in setting up a gas-fitting and stove show-room. The gas-fitters of the town were soon down on them; and they said the company were going to ruin them. The reply of the directors was that the gas-fitters of that time supplied such rubbish in the way of gas-fittings that they felt compelled in the interest of the consumers, even at that date, to take the matter in their own hands, and sell fittings themselves. He sincerely hoped that gas engineers and managers would remember this, and keep to the front the supply only of gas-fittings of good quality and weight, and sound taps. There was no doubt about it that the gas maker and the gas apparatus maker must in future go forward in co-operation, and help the consumer in every possible direction. There was a great deal to be done in this way, in addition to the great deal that was being done. Gas managers had much to do in seeing that their consumers had more intelligent instruction given to them as to how to use gas heating and other apparatus.

The motion was heartily agreed to.

The President, in concluding the discussion, said he need hardly say that he held Mr. West in great respect. But he must honestly say he was not altogether afraid of him [laughter]; and if the time did come the following week for him to face him, he should do so with some courage and some hope of not being on the losing side. He could not help, as he was glancing round the room, having his eye caught by the source of illumination under which they were sitting; and the thought flashed into his mind, What is the relation of this to University education? One could answer from one's life experience, because this had come into existence within one's own memory. And one knew very well that this, the great rival of the gas industry, had not come to its present state of perfection by any casual education, by any superficial dealing with Science. It had not been by evening classes, or by the interludes of the busy man once a week, that the forces had been gathered together which had brought into existence this kind of illumination. And when any gas man thought that those who represented Science tended to overestimate the matter of long-continued, systematic, and very thorough study of what they professed and believed in, he hoped it would be remembered what a tremendous capital of scientific study and scientific knowledge had been laid down in the rival industry and what a tremendous harvest had already been reaped. There was a lesson there which those people who so thought might seriously ponder over to their advantage.

Mr. Yates, in reply, said he heartily appreciated the thanks of the members to him for his small effort. He must say that he was a little disappointed that the members had not really "gone for" him. He was hoping that they would have had some fierce discussion; but evidently his paper had missed fire. ["No."] He had touched upon all sides of the subject, giving the views obtained from his humble experience. He would like to endorse what Professor Smithells had said with regard to University education; for he considered every man who could afford to send his son to a University should do so. Education was the very finest capital they could give their children, and they had better leave them with a good education than with a poor one and a certain amount of cash. He was in full sympathy with what Mr. Duxbury had said as to the profits of gas undertakings. He did not think they should, under present circumstances, be devoting so much to the relief of the rates. He thought the gas-consuming community should receive more benefit from the profits. In this way, they would extend the gas industry to a far greater extent than anyone could imagine. Perhaps they would see gas at the ideal figure of 1s. per 1000 cubic feet. In regard to the scrapping of plant, it was perfectly correct that this must be done with the changes of the times. Those who did not do it, because they considered they could not afford it, would soon be out of the running. The most successful firms of the present day were those who had been the biggest scrappers of plant and old ways. They had all to come to it.

Junior Institution of Engineers at Tottenham.

A number of the members of the Institution visited, by permission of the Chairman and Directors, the works of the Tottenham and Edmonton Gas Company on Saturday, the 18th inst. Under the guidance of Mr. A. E. Broadberry, the Engineer and Manager, assisted by members of the staff, they were shown through the two retort-houses, where they saw the Fiddes-Aldridge stoking-machine and the De Brouwer projectors and pushers, and the hot-coke conveyors. A setting of vertical retorts is on order, and when complete the total capacity of No. 1 house will be 3 million cubic feet per day. That of No. 2 house is 3¾ millions. The water-gas plant, consisting of three sets, equal to a total production of 4½ million cubic feet, was also inspected. Some interesting particulars were furnished in regard to the growth of the output since Mr. Broadberry obtained chief control of the works in 1899. In that year, it was rather more than 575½ million cubic feet; whereas last year it was about 1687¾ millions, and it is confidently expected that this year it will be at least 1770 millions. At the conclusion of the visit, the members were entertained at tea; and the Chairman (Mr. Walter T. Dunn) expressed their appreciation of all that had been done to render the occasion so interesting and enjoyable. Mr. Broadberry responded.

The late Alderman Robert Gibson, who for eighteen years was Chairman of the Manchester Corporation Gas Committee, left estate valued at £26,515 gross and £23,286 net.

Lighting of the International Hygiene Exhibition in Dresden.—The authorities of the exhibition have decided on employing Pharos-Welsbach lamps for lighting the Lennéstrasse and the main entrance of the exhibition. There have already been installed eighteen 1500-candle power and nine 4000-candle power high-pressure lamps on lamp-standards, with lowering mechanism, automatic distance lighters, compressors, &c. The extent of the satisfaction given by this system of lighting will be readily appreciated when it is mentioned that the Pharos-Welsbach light has earned the distinction of being awarded the "Grand Prix" and also the "Prize of Dresden."

Manchester University Lectures.—Mr. R. G. Shadbolt, the President of the Institution of Gas Engineers, and Past-President of the Manchester District Institution, is announced to occupy the chair on the occasion of the second lecture of the present session, next Saturday, when Mr. E. W. Smith, M.Sc., of the High-Pressure Gas Laboratory, Birmingham, will follow up the lecture he gave at the opening meeting in October, on "High-Pressure Gas: Theory and Practice in its Application," by dealing specifically with "Some Aspects of Distribution." Mr. Smith proposes to illustrate his lecture by a series of practice experiments with high-pressure gas. Members of the Manchester and District Junior Gas Association are notified that following the lecture (and after tea) a discussion will take place on the points raised by Mr. Smith.

Corrosion in Reinforced Concrete.—It is stated in the Engineering Notes of the "Manchester Guardian" that in the current issue of "Concrete" Dr. Desch discusses two instances of serious cracking in reinforced concrete believed to be due to electrolytic corrosion of the steel reinforcement. One refers to a large packing warehouse in New York, and the other to a jetty at Southampton. Cracks developed; and, in the New York instance particularly, the concrete broke away in several places. Investigation showed in both cases that there was leakage of current from adjacent electric lighting and power circuits through the concrete and its reinforcement. In both instances, also, the concrete was exposed to moisture containing salts. Hence all the conditions existed for the slow electrolysis of the salt solutions at the surfaces of the steel reinforcement. Laboratory experiments carried out confirm the impressions gathered from the failures that electrolysis may be the cause of serious cracks in concrete. If the current density is high, cracks may develop in a few hours; but under these conditions fracture appears to be mainly due to the heat generated. With low-current densities, true electrolysis takes place; and the iron is deeply oxidized. Owing to the fact that the oxide occupies more space than the original iron, the concrete is subjected to bursting pressures, cracks are formed, and ultimately complete failure may occur. The chief precaution to be observed would seem to be to see that all electric wires are amply insulated, and that all the reinforcement is connected by wires to bring it to one potential.

CARBONIZING

WITH SPECIAL REFERENCE TO HIGH MAKES.

By E. G. Stewart, of the Gaslight and Coke Company.

[A Paper read before the London and Southern District Junior Gas Association, Nov. 24.]

Carbonizing, that process of the distillation of coal which forms the primary and essential business of the gas engineer, in consequence of its importance, and possibly as a result of the slight element of mystery accompanying it, has always been a subject of fascinating interest to the members of the profession. Of recent years, the advent of radical changes in the plant and methods employed, and, perhaps, to some extent, rivalry between manufacturers, have developed a thirst for "results" among those interested. In consequence, there is a growing tendency nowadays to rank an engineer's skill by the results from the plant he controls, and, in particular, by the "make" per ton he succeeds in obtaining. A wide, if not long, experience in some half-a-dozen Metropolitan and Provincial works, of medium and large capacity, containing nearly every modern type of stoking machinery and carbonizing plant—horizontal, inclined, and vertical—has convinced the author of the fallacy of showering praise on the "high-make men," without an acquaintance with the conditions under which they work. At these works, the makes range from 9000 to 13,000 cubic feet per ton; and a consideration of the factors which cause this variation, in the form of a general survey of the carbonizing process, from this somewhat novel point of view, will, the author hopes, be of interest to the members of the Association, and provide food for discussion. At the very outset, one realizes that the question is one of economics; and, as a Junior Association, it is outside our scope to consider, in detail, any financial influences, except to notice where they become of importance.

Briefly put, the crucial points of the question may be summed up as local conditions and management. The local Act of Parliament regulating the quality and purity of the gas produced is of primary importance. Next there is the geographical position of the works, and its relation to coal-fields, rail-tracks, canals, and the sea. Then the markets for bye-products—coke, tar, and ammonia—and also the question of producing all, or any, in good quantity or quality, next claim our attention. Finally, there is the plant available; for it is in this connection that so much depends on management.

Quality of Gas.

The quality of the gas is, perhaps, the primary and most dominant factor where the make is in question. A lower quality obviously tends to an increase in gas produced—such quality being regulated by the statutory candle power, and the test burner used. The No. 2 "Metropolitan" test burner, now so generally adopted throughout the country, stands pre-eminent in developing to the full the true illuminating value of any gas, especially if it be of a low or medium grade. A variety of causes, arising chiefly from climatic influences, and the locality and altitude of the point of combustion, result in a depreciation—partly apparent, and partly real—of the quality of the gas in its journey from the works. It is necessary, therefore, to manufacture a quality of ¼ to 1 candle, or more, in excess of that supplied; and this higher value becomes the real working standard. Plotted curves will show that, the higher the atmospheric temperature, the better is the district return in exact proportion; and this is most noticeable when the test photometer is connected to a slow-draught main—another factor, and a troublesome one, too, in cold weather. The atmosphere of the test-room has a greater influence than might be credited; the presence of flue gases from leaky stoves, &c., detrimentally affecting the gas-flame to a greater extent than the standard pentane, and so resulting in a low return. The chief influence of the standard of purity is noticed in determining to some extent the class of coal to be employed, especially in the case of a stringent sulphur test; though, happily, this is a burden which few companies are called upon to bear nowadays.

At this point, it is well to mention the position of carburetted water gas. If this can be produced cheaper than straight coal gas, and the coke market is flat, advantage is often taken to reduce the quality of the gas, to the benefit of the make, and bring it up with rich oil gas. It is a moot point, however, whether this is always a financial success; and it entails, also, a certain amount of risk with the district return—especially where a No. 1 "London" burner is employed, as, from observations of the flames, the author thinks that the mixture tends to separate, and travel in "blocks," so to speak, along the gas-mains—the mixture not remaining homogeneous.

Coals.

The very nature of the process of gas making renders it obvious that the brand or brands of coal employed should be closely considered when comparing and criticizing makes. It is, perhaps, one of the most important branches of a gas engineer's many-sided knowledge to be acquainted with the properties and the peculiarities of the numerous seams of gas coal. Especially so is this the case with verticals, and the newer forms and methods of horizontal carbonizing; for, true to their antiquity of origin, many coals do not take kindly to these modern methods. The local position of the works usually determines the nearest or the cheapest transported coals. The cost of carriage being a large proportion of the total final cost of the coal, the question of reducing it to a minimum is of the utmost importance. It may, and probably would, be economical to buy good quality coals where freightage is high; but this is often limited by the undertaking being unable to pay more than a given inclusive price. A good coal, though, may not necessarily mean good results. There is always the question of its suitability to the carbonizing plant employed. It is here that the saving virtue of horizontals comes into play. Perhaps in the case of swelling coals and heavy charges, it is necessary to exercise a little care with them; but otherwise one can carbonize any coals with the minimum of trouble. With slopers, as is well known, the angle of inclination, condition of the bottom of the retorts, and the height of fall from the bunkers, all militate against the use of certain seams. With verticals, especially those of the continuous type, the swelling and softening of many coals during the preliminary stages of carbonization, until the advent of recent developments, in the shape and dimensions of the retorts, gave serious trouble; and with swelling coals, even the intermittent type of verticals at times give trouble through "hanging," though the difficulty can be easily overcome. In these cases, verticals have given improved results with shrinking coals, which, however, bind on the bottom, in the case of horizontal and inclined retorts, and so give difficulty in discharging. This shows how the suitability of the coal has to be carefully looked into, with all these newer methods of carbonizing.

The physical condition of the coal has a certain amount of effect on the results. With fine coal, for example, it is not so easy to get as good an efficiency as with large coal of the same seam—especially with verticals. The make and multiple increase with the size of the lumps, up to about ¾-inch cube. The washing of coals renders their use with projector-chargers a less dusty process; and, at the same time, it materially reduces the sulphur impurity in the resulting gas—a useful property, where stringent tests are in vogue, from the point of purification costs. The absence of dust incidentally results in a diminution of stopped pipes. The use of screened coal in inclines makes working easier; and, of course, the nuts are ideal where projector-chargers are in use. The percentage of ash and moisture in the coal are of importance, not only from the point of view of value received, but because of their effect in working. The moisture entails the use of more fuel, though it has a compensating advantage in that damp coals usually work more easily than dry, in all types of plant, and notably so in verticals. The ash becomes of importance in connection with the working of the resultant coke, whether in the setting furnaces or carburetted water-gas generators, as coke with more than 12 per cent. of ash usually results in heavy clinker. Incidentally, the composition of the ash determines the properties of this clinker—whether brittle or sticky, for example. As coal gives off a proportion of its gas upon exposure to air, it is evident that the time elapsing between the mining and carbonizing has its influence on the make, and should be reduced to a minimum where possible. Though it appears obvious that many of the questions of quantity, &c., of the products are settled in the coal-store, the fact does not seem to be so generally acknowledged as to render repetition superfluous.

The Process of Distillation.

Starting from this point, the conditions of distillation next claim attention; for it is here that the various methods of carbonizing and types of plant in use exert their influence on the quantity and quality of the resulting products, though not to such an extent as might appear at first sight. The choice of the many arrangements at present in vogue may be regulated, for the greater part, by labour, capital, and upkeep considerations; but from a "make" point of view, all the systems may be divided broadly into two classes, which may be designated as "layer" and "mass" carbonization. Under the former are included horizontal and inclined retorts worked with light or with medium charges; and in the latter division, full retorts, however worked, verticals, and chambers. Considering these in order, a few notes on the working and in connection with the results obtained will, the author hopes, prove of interest.

With the coal in a retort in a layer, up to (say) three-fourths the depth, the modern and mechanical methods of putting it in are many. The essentials are that it should be in a layer of even thickness, and continuous from end to end of the retort. With horizontal retorts, apart from labour, &c., considerations, these ideals are fairly easy of attainment. The many types of charging machines extant—on the scoop, ram, projector, and chain principles—succeed in this object for the greater part, though the chain type is far ahead of the others in efficiency. Tailing-off of the charge towards the mouthpieces, and heaping-up in the centre, are serious faults in charging, which ought to be avoided, as they reduce the make, and also lead to other bad results. With even moderately heavy charges, an excess of coal near the mouth is difficult to avoid. It helps to keep the pipes clear; but as some of the coal is under-carbonized, a reduction of the make, by as much as 100 cubic feet to the ton, is likely to ensue.

With inclined retorts results as good as with horizontals can be obtained, though, in the present rush of new ideas, they are apt to be forgotten. As before, a smooth even layer is necessary. To ensure this, suitable coals and smooth bottoms to the retorts are requisite. Without them, trouble is bound to result. In the first case, the coals may slip, and result in a half burnt-off charge (an analogous case to an unevenly charged horizontal); and in the second, the coals may never reach within some feet of the lower

mouthpieces, which causes abnormal trouble with pipes, pitched hydraulics, and naphthalene, consequent upon the excessive free space. And, in addition, there is the trouble in drawing and the reduction of charge and output.

The salient feature of the "layer" system, which exerts its influence on the results so far as the volatile products are concerned, is the free space above the charge. It is here that the issuing gas becomes baked and cracked up by the radiant heat from the crown of the retort, which results in an alteration of the composition of the gas, tar, &c. A shorter duration of carbonizing, or a heavier charge, obviously necessitates a higher retort temperature; while a large charge reduces the volume of the free space, increases the velocity of the gases, and thus, by reducing the exposure time, lessens the gas temperature, in spite of the higher retort heat. In this connection, figures lately published by Mr. J. Ferguson Bell are of interest. The retort in question was of ⏢ section, 22 in. by 16 in.

Weight of Charge. Cwt.	Depth of Free Space. Inches.	Duration. Hours.	Average Velocity of Gases. Feet per Minute.	Average Temperature of Gases at Mouthpiece. Deg. Fahr.
8 ..	8½ ..	8 ..	9 ..	885
10 ..	7 ..	10 ..	12 ..	709
12 ..	5½ ..	12 ..	17 ..	617
14 ..	3⅞ ..	14 ..	31 ..	451

These show the marked reduction in temperature which is attained by the issuing gas as the free space is reduced. Where only one ascension-pipe is employed, the greater time-exposure of the gas from the far end of the retort shows itself in trouble with blocked pipes, where the heats are high. The writer is acquainted with several large retort-houses where the addition of a second pipe to the hottest retorts has, by reducing the average temperature of the issuing gases, effectually overcome any such difficulties.

With carbonizing systems working on the "mass" principle, the charge first cokes on the outside; and because of this, and also the absence of a free space, the gas passes away through the cool core of the coal, and does not suffer the breaking-down effects of the baking in an open space, as with the "layer" system. Within limits, the results produced have a similarity to low-temperature carbonization in ⏢ retorts, with medium charges. The results given from any of these vertical, filled-up retorts, or chamber plants, which are more or less common to all, are increased makes of good quality gas, no stopped pipes, reduction in naphthalene and sulphur compounds, more ammonia (but less cyanogen), and a better class of coke from most coals, denser as a rule, though lighter with continuous verticals.

Horizontals.

The system of heavily charging horizontals has now become so common, as a result of the competition of verticals, that the question of the putting in and taking out of these charges becomes of importance. Practically, the best charging machines are the projector and ram types, when the retorts are required quite full. The first has a tendency to pack the charge if care is not exercised; otherwise it is the easier and cleaner type of machine. But, in view of the fact that a completely filled retort is rarely worked, the best charges and results are found, in the author's opinion, where the operation is performed by a simultaneous machine. The wear on the retorts is less; and owing, no doubt, to this, and to the perfect shape of the charge, it pushes out easily, and gives off its gas without much cracking-up—conducing to excellent results. So far as heavy charges are concerned, the discharging can only be effected by pushing out; rakes being out of the question. This operation is more often than not attended by more difficulty than charging. The principal causes are primarily in the retort itself. A rough interior, such as results after (say) 600 days' working, and is noticed especially after scurfing, holds the coke, and so the pusher-head crushes and wedges-up the face of the charge, after which pushing out is a matter of violence. Otherwise the retort must be hand drawn, if not entirely, say 6 feet from either end. A dropped bottom to the retort is a trial to the best pushers, as it tends to collapse the charge, and so causes blocking; while there is always the question of scurf, which jams the pusher-head, resulting in bent rods or rams and wear due to the hard rubbing. In fact, it will be noticed that the retort usually wears to a funnel shape, with the small end nearest the machine; and when, in the case of a breakdown where there are pushers on both sides of the bench, it becomes necessary to discharge a retort by the opposite pusher to normal working, the small end being now on the far side, jamming results in the majority of instances.

Secondly, there is the question of the charge itself. If of uneven thickness, or thinner in the centre than at the ends, it may collapse; while the opposite state of being thick in the centre and thin at the ends, usually results in jamming. Some charging machines—chiefly those of the scoop type—are very prone to produce this latter type of charge, by ploughing-up the coal on the second entry. Tailing-off of the charge towards the mouthpiece is also a trouble, as the pusher-head either runs up the wedge and jams on to the retort-crown or else the intensity of pressure on the small face of coke is too great, and crumbling, followed by wedging, ensues. An insufficiently carbonized charge also proves a difficulty, owing to its adhesion to the retort.

Finally, as to the design and working of the machine. Too many have insufficient power at disposal, and so have to make up for it by racing in at a high speed, which often results in jamming the charge, and then proceeding to force it out by a species of hammering action—by entering the retort at full speed, and coming up against the charge till the motor pulls up, and then repeating this again and again, till all the coke is pounded out. This is an operation destructive alike to machine and retort.

Where, as with projector machines, much scurf is formed, a series of pusher-heads of different sizes are best kept in use, and changed when need arises. One should, however, guard against the use of too small a head, as some of the coke gets behind it, and gives trouble by wedging. To prevent the charge sliding up the pusher-face, a hood plate at the top is best employed. This remedy is now adopted in some of the patterns of machines on the market. For easy discharging, a slow steady push, not exceeding 1 foot per second, is the best; and broken or jammed charges are then a rarity. The hydraulic and simultaneous machines achieve this; and no doubt it is the secret of their working. As the motion is not fast enough to admit of hammering, all the broken charges must be hand-drawn; so it is advisable to see that the charges are good and well burnt-off, and to break up the far end from off the mouth of the retort, to stop adhesion there, if there are to be no troubles.

Inclined Retorts.

In the author's opinion, it is not advisable to completely fill "slopers." The results are similar to those given by full horizontals; but the difficulties of charging and drawing take up a good deal of time, and involve loss of gas and much labour.

Verticals.

The last decade has seen the application of science to carbonizing in a manner never before attempted. The "mass" principle was early recognized as the ideal. But the evolution of a type of plant to successfully apply it has been a matter of time; and the path of progress is strewn with many failures. True, these efforts stimulated inquiry into the conditions obtaining in existing plant, with results before mentioned. Nevertheless, it is to the vertical retort that we must turn for perfection in carbonizing. The intermittent system reached finality while most others were in their cradles. Few are the modifications which have been adopted in recent years. The number of retorts per bed has been increased to eighteen, with the idea, successfully realized, of saving fuel. The operation of three retorts simultaneously has increased the output and decreased labour. A new grateless furnace has been introduced, which reduces cleaning to once per week. Still, these are finishing touches; the main points remaining unassailable. The setting is easily controlled, the wear and tear low, and the results good. But with all this, there still remains the disadvantage that, except the installation is large, the production of gas is neither regular in quantity nor in composition. So that it is in the continuous system that the ideal must be sought. Here the elimination of the many difficulties has been slowly but surely accomplished. Practical perfection is now at hand. Continuously revolving feed and discharge devices have been abandoned, owing to the impossibility of keeping air out, or gas in; the retort being of a positively closed type. The coal feed in nearly every type now takes place from an intermediate hopper gas-tight, and under retort gas-pressure, which is recharged from the bunkers by a valve about every two hours. Similarly, the coke discharge takes place into a closed chamber, emptied also about every second hour.

The semi-continuous types do away with gas pressure in these hoppers, by keeping the retort itself closed by valves, and partly emptying and recharging about every four hours. This seems a half-way measure, and its ultimate survival is doubtful. Certainly, all machinery is avoided; but now in the true continuous systems there is only the extractor, which requires little power and less attention. The timing of it enables the speed of carbonization to be regulated in an unequalled manner, so as to extract the maximum of gas with a minimum of fuel. The settings for the continuous type have been the subject of very much thought and experimenting; and here, again, the fittest have survived. The tendency is to make the retort broad longitudinally in proportion to its transverse width, as this is found to secure easy and regular motion of the charge. The retorts are strongly built and supported, and the arrangement of flues free from complication. The greatest difficulty is the expansion on raising or lowering heats, so that care is required at these times—more so than is the case with the usual horizontal or inclined bench. But the regulation is at once simple and convenient; the heats being easy to obtain and control. Regeneration is now applied more than ever; in one type even the coke heating the secondary and in another the primary air. The scurf is less than one-half that produced with filled-up horizontals, and is of much less density. All this tends to a low fuel account, which is borne out in practice—as low as 10 per cent. being attained. The retorts being always closed, no dust or smoke can arise. Neither is there the noise of machinery nor the clouds of steam from hot coke; and stopped pipes are a thing of the past. What labour there is, is small, and by no means arduous. The heavy imposing retort-house of yore gives place to a light, panelled structure of half its area, and of which the bench ironwork forms part. The results are uniformly good, and will be considered later.

Chambers.

The chamber is a system of "mass" carbonization, which has made good progress on the Continent. It gives results similar to

other "mass" systems. It is interesting to note that recent developments have aimed at keeping the crown of the chamber fairly cool; it being found advantageous to avoid cracking-up in such free space as does exist there. There is some difficulty in keeping the chambers air-tight; and the system has not met with much favour in this country, probably because the illuminating power of the gas produced is low.

Management.

Such, then, is a brief survey of the modern systems of carbonizing. But however near some of them may approach the ideal, their adoption cannot be at once universal. So the question of getting efficiency from existing plants to the full extent of their capacity is of as great an interest as the development of improved types. It is here that management becomes of the greatest importance. High makes can only be secured by the most watchful attention in the retort-house, whatever its type; every care being used to obtain the most from the coal. Tight retorts, lids, and feeding and discharging devices, a maximum number of retorts charged out of those in action, no lids left flaming after charging, and even and high heats, correctly and economically regulated, are absolutely necessary. With intermittent working, the charges must be fully, but not over, burnt-off—a point usually shown better by a pyrometer than by an inspection of the retort. Coals should be kept off the mouthpieces, and all half burnt-off coal and tarry matter collected in tar-trays and returned to be carbonized. This is a wrinkle which not only tends to economy, but prevents a great deal of smoke in the house, besides removing the most potent cause of fires in coke-hoppers, where these are installed. The pulling of air or flue gases should also be avoided; for though it seems an easy way to get a high make, the writer does not agree that it gives efficient results, and strongly deprecates the practice. Such points as these are a tithe only of the many which practice teaches; for, as Mr. Corbet Woodall has said, gas engineering is like farming or seafaring, it has to be lived in to be mastered.

Difficulties.

Having now seen the limitations of coal, plant, and management in producing high makes, a consideration of the effects of the struggle, first on the plant, and then on the works and products, will complete this review.

In the retort-house, where the "layer" principle of carbonization is of necessity employed, a host of troubles awaits the high-make enthusiast—stopped pipes, pitched hydraulics, naphthalene, high sulphur, increased wear of machinery, and worry with the heats, are a few. With the latter, when settings are being worked to their utmost capacity, the appearance of clinker, and bad feeding, or anything likely to upset the working of the furnaces, results in an immediate drop of the heats, and consequent loss of make. Proper filling of the furnaces, then, becomes a necessity; and in the case of the large furnaces now in use it is of importance to ensure the coke being well raked over to the back, so that the fuel-bed is of even thickness. Clean fires and flues and properly set dampers are, of course, essential for economy. The higher temperature of gases entering the ascension-pipes results in blockages; the deposits being sometimes hard, and at others powdery in nature, especially where the radiation from the pipes is hindered by inefficient ventilation of the retort-house or where they run close together. Tar deposited in the hydraulics is of a thick pitchy nature, as the following analyses by the writer will show. They are by no means a good example; the charges being rather heavy, though the heats were high—about 2000° Fahr.

	Tar from Retort-House.		Tar from Condensers.
Water	5	..	5
Light oils	1	..	7
Carbolic and creosote	14	..	32
Anthracene	2	..	6
Pitch	78	..	50
Specific gravity	1·4	..	1·1

These tars were sampled simultaneously; and the composition of that from the retort-house makes plain the fact that its best constituents have gone into the gas. With such a tar, the only way to ensure that the mains will not pitch-up is to remove it as soon as formed; otherwise a hot blast of gas, such as results from over-pulling, with its accompanying lampblack, will soon make trouble. Tar-towers, coupled with an ample and continuous flow of liquor (best pumped over and over in good quantity), together with watchful care, are the remedies. The retort-house governor by preventing over-pulling to a great extent acts as a help; and the author thinks that the better makes obtained where these governors are installed are in reality due to their effect in reducing pipe and main difficulties. Outside the retort-house, troubles are mostly from naphthalene and thick tar blockages.

A consideration of the ways and means of dealing with naphthalene is unnecessary here; the problem, in fact, having been solved by Dr. Colman in his Southern District Association inquiry. Of course, prevention is the best thing, where circumstances permit. Otherwise, it is necessary to use solvent and carburation processes, unless, as is done successfully in France, the gas is cooled down as it leaves the hydraulic main, and the oils it contains (taken from the tar) used as solvents. At least, the difficulty can be overcome. With thick tar, the only cure is continual cleaning of the mains and valves, though the use of naphthalene solvents often has a secondary action in helping to keep the mains free from bituminous matter.

Other minor annoyances in this connection are the increased proportion of impurities, particularly carbon dioxide, which is noticed more where lime is used for purification, as it locks up the material before much of the carbon disulphide is removed, and so increases the costs to no inconsiderable extent.

These troubles are the direct result of forcing the plant with an unsuitable system, and so can easily be avoided. A careful watch on the jet and exhausters is a necessity for a high make, and high heats are a *sine quâ non*. But the system, for easy working, ought not to suffer the gases to be exposed to these heats. Therein is the solution of the problem; and if this were remembered, and always convenient, larger makes (without the usual disadvantages and the use of a high vacuum) would be obtained.

Composition of the Gas.

Perhaps nowhere is the influence of the make and the methods which have led to it shown so aptly as in the analyses of the resultant gas. The hydrogen and methane content indicate the degree of cracking-up the gas has undergone; while, subject to limitations, the nitrogen present indicates the extent of adulteration of flue gases and air. To show the difference between high and low temperature carbonization, I give the following analyses of gas from the same cargo of coal, and worked, with the exception of the heats, in the same plant and under exactly similar conditions:—

Retort Temperature.	Make per Ton.	I.P. No. 2.	Net Calories.	CO_2.	O_2.	Hydrocarbon.	C_6H_6.	H_2.	CH_4.	CO.	N_2.
Fahr.											
1830°	12,850	14·0	121·0	·38	·57	3·44	·38	49·19	28·7	7·26	10·06
1370°	10,500	18·0	137·0	·09	·56	3·53	·40	46·43	32·84	6·04	10·10

These analyses clearly indicate the splitting-up of the hydrocarbons into hydrogen and carbon monoxide, as the temperature increased. The constant nitrogen figure is a proof that this gas was all from the coal, which is also borne out by the carbon dioxide and oxygen percentages. It is of great importance to note this, as a high nitrogen content may not always indicate that any external means of padding the make have been employed. Many coals have a large proportion of occluded nitrogen in their composition, which is evolved on carbonization.

When on the works a low-quality gas is found, the cause may be determined rapidly, other than by a nitrogen test, by means of a specific gravity bell. As an extreme case, the author has found in two gases of 9-candle power (as tested by the No. 2 "Metropolitan" burner) that one due to over-pulling had a specific gravity of ·69, and another which was the result of a burn-off was of a density ·39. The reason for such wide differences as those found is clearly shown by the comparative analyses in the following table:—

I.P. No. 2 Met.	—	CO_2.	O_2.	C_6H_6.	Hydrocarbon.	H_2.	CH_4.	CO.	N_2.	Sp. Gr. Air = 1.
10·0	Pulling	2·50	3·0	..	1·5	43·0	10·0	6·50	33·0	·56
10·0	Burn-off	·60	1·4	..	1·5	65·0	23·0	·50	9·0	·31

The relative proportions of hydrogen and nitrogen will be noticed. These may help to show how important the nitrogen question is; and many record makes would be sadly diminished were the content of this gas limited to 10 per cent.—a reasonable figure, considering that some vertical systems (with suitable coals) have succeeded in lowering it to the region of 4 per cent. The following analysis from a district supplied with straight coal gas almost furnishes its own comment, as illustrating how some makes are obtained:—

I.P. No. 2.	CO_2.	C_nH_m.	C_6H_6.	O_2.	CO.	CH_4.	H_2.	N_2.
15·0	2·5	2·2	·4	1·1	4·8	32·0	42·0	15·0

The carbon dioxide, oxygen, and nitrogen are sure proof of the addition of flue gases; and the quality would seem to indicate a good gas "stretched" to its fullest extent. With intermittent vertical retorts, it has been found possible to increase the yield of gas some 8 per cent., with only a small drop in the quality, by the addition of steam, provided it is done during the last two hours of the carbonizing, resulting in a slight increase of the hydrogen, at the expense of the methane, and rather more carbon dioxide. After all, the greatest necessity is to keep the gas, not only above standard quality, but of constant composition, no matter what that composition may consist of. Perhaps with intermittent charging, especially in small works, this is a matter of some difficulty; but with continuous carbonization—now within reach

of success—it ought to be an easy matter to maintain with any coal a "standard" gas.

Residual Products.

Final considerations are those of the residuals; for, obviously, a large make must mean a depreciation either in quantity or in quality of some of the other products. The total quantity of coke and breeze produced from any given coal seems little affected by the method of its production; though, naturally enough, the treatment in handling, and the density of the coke, make a difference in the proportion of breeze. Generally speaking, the coke made from any of the "mass" systems is hard and dense, almost resembling oven coke. Exception must be made of that resulting from continuous verticals, which is large and light—its hardness or friability depending on the coal. Continuous verticals produce also a quenched coke with a remarkably low percentage of water—less than ½ per cent.; whereas with horizontals, and especially with coke conveyors, 10 per cent. is not uncommon. In the manufacture of the coke, the question of the consumers' special needs may possibly have to be thought of. The hard dense type is very difficult to light (especially when the percentage of volatile matter has been reduced by "squeezing" for high makes), and so is not of much use for domestic purposes. At the same time, the other extreme of a spongy friable coke (the joy of the dealer who buys by the ton, and sells by the bushel) is a greater nuisance, as it makes much breeze, and gives a lot of dust in burning—one of the popular prejudices against coke. In spite of the weight of the coke made remaining the same with different carbonizing plants, the calorific value of that produced with high heats and containing but 2 per cent. of volatile matter, or less, shows a marked difference from the older low-temperature cokes, as the following tests of cokes from the same coal will prove:—

Temperature of Retort.	Calorific Power in B.Th.U. per Ton.	Weight of Coke and Breeze per Ton.
1800° Fahr.	12,848	15·0 cwt.
1400° ,,	13,028	14·9 ,,

The fluid residuals exhibit similar characteristics, where high makes are aimed for. The tar, like the coke, shows little variation in quantity with the plant employed. The difference in quality, however, is most marked, as these analyses, carried out by the author, make plain:—

	Works Using High Heats and Light Charges. Per Cent.	Works Using Moderate Heats, and Fairly Heavy Charges. Per Cent.	Continuous Vertical Retorts. Per Cent.
Water	2·0	2·0	2·0
Light oils	1·0	6·0	5·6
Carbolic and creosote	14·0	32·0	41·4
Anthracene	5·0	4·0	4·0
Pitch	78·0	56 0	47·0
Free carbon in pitch	36	17	5·5

The improved quality of the tar produced in the vertical retorts is at once seen; the very low percentage of free carbon being, no doubt, due to the entire absence of any free space. The deleterious effects of such space are well illustrated in the first analysis, as is also the extent of extraction of the lighter oils in these systems.

With regard to the ammonia, a low temperature is, of course, most favourable; and so of modern high-temperature systems the "mass" types are the best for ammonia yields. The gas not being heated over the coke, though, results in a reduction of cyanogen yield—a residual, however, of little importance to the majority of gas undertakings. A fair average result is:—

	High.	Low.
Gallons of ammonia 10 oz. per ton	28·9	30·2
,, blue 1 lb. strength.	3·25	2·25

The receipts from residuals being about one-third of those from the gas, they assume some degree of importance; so it is as well to point out here that when considering a high make, and plant for producing it, the question of its influence, primarily on the coke made, and also on the other residuals, may become a factor of no mean importance.

Conclusion.

In the foregoing, the author has attempted—of necessity in a rather incomplete manner—to review the whole field affecting large makes per ton. Remembering always that from a ton of coal there can only be obtained a very little more than a ton of products as an outside limit, we are in a position to sum up the carbonizing question, so far as the make is concerned.

Firstly, it depends on the coal employed. If there is not the gas in the coal, no means will extract a big make from it. Secondly, the quality which must be produced regulates the amount by which the percentage of the total evolved hydrocarbons can be reduced. Finally, the plant employed and success of management control the extraction of the various products in their requisite qualities and without waste or depreciation.

The conditions for the production of a large make being favourable, two things are needed—a suitable system and constant supervision. Good results can be, and are being, attained without tar and naphthalene troubles—usually the result of the application of high heats to a system intended for low heats. Keeping the coal hot, and the gas cool, is the whole secret; and so far as the results are concerned, with good management the bulk system in its several guises would seem to give equal satisfaction. Undoubtedly, in the form of continuous verticals, the ideal of carbonizing is near at hand. The absence of noise, dust, smoke, and arduous labour, coupled with the production of coke ready for use, and an unvarying quantity of gas of uniform quality, and the small ground space and neat retort-houses, can only tend in course of time to put the system into a foremost place for the production of gas; the extent and rate of its adoption being regulated by the capital and working costs of those competitors of which the intermittent vertical and the horizontal with combined or simultaneous machines are the most to be feared.

[The paper was illustrated by a considerable number of diagrams and some models.]

Discussion.

The President (Mr. J. G. Clark, of the Gaslight and Coke Company), in inviting discussion, complimented the author on the paper.

Mr. T. F. Canning (Ilford), referring to the statement in the paper that carburetted water gas travelled along the mains in "blocks," said he thought at the present time the general opinion was that it did not do so. It might depend to a certain extent upon the method adopted of mixing the two gases; but apart from this, the general introduction into gas-works of carburetted water gas seemed the best argument against any theory of the kind put forward. The author appeared to look with an unfavourable eye upon the high-make man. In this respect, he (Mr. Canning) did not see that the analysis given really proved anything. To his mind, it all depended upon the conditions. Before accepting an analysis as conclusive evidence that there was "padding" in a gas, one wanted to know the exact circumstances under which it was made. He had seen an analysis like the one given in the paper, which was taken of gas from a new setting of retorts—that was to say, new retorts entirely—and with a level gauge. If he remembered rightly, the percentage of nitrogen was about 24, and of carbon dioxide 5; and the illuminating power was something like 11 candles. Thus the evidence of analysis did not seem to his mind conclusive. Regarding the figures given for the calorific value of coke in B.Th.U. per ton, the difference at the two temperatures appeared extremely slight; and perhaps it might be accounted for by error in the calorimeter.

Mr. W. H. Vanner (Walton-on-Thames) asked what precautions were taken in lighting-up outside producers; and he also expressed a desire to see a comparison of the fuel used by a producer of this type with that needed by a producer built under the retorts. Had the author found, with a certain type of stoking machinery, any wear and tear on the bottom of the retort? Then what method did he employ for removing carbon, and had he tried any plan for preventing tar and pitch forming high up in the ascension-pipe? There were various ways of accomplishing the latter purpose. One he had seen illustrated was to have water dropping from a sort of tank over the arch-pipe. This was allowed to flow at such a slow rate that it formed into steam instead of dropping as water just on the mouth of the ascension-pipe. Had the author had any experience of the life of sectional retorts built up by hand, as compared with machine-made retorts? With reference to high makes, Mr. Stewart was rather hard on the retort-house foreman in respect to his analysis; but he thought a great deal of it probably had to do with such a suggestion as that if the foreman could show an increased make per ton over the half year, his wages would be raised.

Mr. W. T. Burton (Leatherhead) thought that to speak of making a gas from ¼ to 1 candle in excess of the standard supplied, was quoting rather a wide margin. As to gas travelling in "blocks" in the mains, he had noticed something of this kind, when the works were making in and out of one holder—from "hand to mouth" as it were—during the winter.

Mr. J. Hewett (South Metropolitan Company) inquired what method was used for estimating the nitrogen. Also, with regard to the 33 per cent. shown in the "pulling" sample, in what part of the charge was this contained.

Mr. D. C. Cross (Lea Bridge) referring to the point made as to gas going into and out of the holder in "blocks," said he thought the reason of it being in "blocks" was that the coal gas coming from the retort varied practically every five minutes in quality; and the inlet and outlet pipes of the holder were so close together that the gas as it went in came out again at once without having a chance of mixing with the rest of the gas in the holder. This was why a variation in quality was noticed along the mains. Carburetted water gas was of much higher quality than coal gas; and if they stopped putting the mixture in the holder they at once had a drop.

Mr. Burton said he spoke of all coal gas.

Mr. Cross replied that the same thing happened with a mixture as with all coal gas. Continuing, he pointed out that Mr. Stewart had said very little about inclined retorts. Most of the experience at his own works had been with inclines; and the best results had undoubtedly been obtained with heavy charges. They could not get such heavy charges in inclined retorts as in horizontals, owing to difficulty in getting the charges down. In some cases they would stick, and with certain coals they would rush down and block up the mouthpieces. A great deal depended upon the coal that was used. A mixture containing half nuts seemed to be better than all nuts. If all nuts were used, bad coke and choking-up resulted. As to high makes, what they wanted nowadays was not so much high illuminating power, because carburetted water gas would give this. What they required was gas. The residuals did not suffer sufficiently to stop people going in for high makes. Another point was with regard to nitrogen. The author said that

when they had a high percentage of nitrogen it indicated that they were pulling in air. Did he not think that with high heats the ammonia was split up, and the higher the heat the greater was the effect on the ammonia, and the larger was the quantity of nitrogen formed in this way? He himself found that the higher the heat, the less ammonia they got; and he thought this was one cause of the nitrogen. Coming to tar, the higher the heat the thicker was the tar. At very small gas-works where they sent the tar away to distillers, it was not necessary to worry about the quality, as they obtained the same price for a good as for an indifferent tar. As to efficiency in the retort-house, if they got into a routine there was not a great deal of trouble. Watching the heats seemed to be about the most important point. There were several things they had tried at his works which had increased the efficiency of the retort-house, and at the same time brought out higher makes. The first of these was putting in retort-house governors. They minimized the fluctuation of the exhausters on the mains, and made a great difference in the makes and also in the stopped pipes. The second thing was a liquor seal. They ran liquor in continuously. The liquor running in in this way kept the heavy tar formed with high makes away from the gas; and he thought the fact that heavy tar had a detrimental effect on the gas was proved by a paper he had read only a few days ago. An experiment was tried of passing 13-candle gas through heavy tar when it was cold; and when the gas came out, the lower candle power showed the heavy tar did dissolve a good deal of the hydrocarbons. When the tar was heated to 400° Fahr., no candle power was lost. He thought that with high makes it was an advantage to get rid of the heavy tar as soon as possible. One other point was with reference to the naphthalene trouble they experienced with high makes. A very good thing was to use water gas tar in the hydraulic—to run light water gas tar in occasionally. This seemed to help the gas very much; and it assisted them in their naphthalene trouble. It also cleared away the heavy tar.

Mr. A. F. Browne remarked that the author had shown a great grasp both of the theory and practice of retort-house work. He was glad to find it was not with high makes that Mr. Stewart had any quarrel, but with the fallacy of supposing that the production of high makes was the only measure so to speak of a manager's efficiency, without looking at the material with which he had to deal. This was a perfectly correct attitude. In comparing the results attainable at one works with those at another, it was essential to take local circumstances into consideration. Then in connection with high makes, it should not be forgotten that it was not everywhere that the practice of correcting for temperature and pressure obtained. To those who did not do it, he did not know it mattered much. The gas was there. But when they came to questions of comparison, if they were to arrive at any satisfactory result they must all correct to a common temperature and pressure. The matter of the travel of the gas along the main had been dealt with by one or two speakers; and he rather hoped that in his reply the author would tone down his statement in this respect. He (Mr. Browne) had known for many years that the law of the diffusion of gases was a lazy law; but when the gas had travelled to the holder, been through it, and gone out again on to the district, he really found it hard to credit that such a condition of affairs as was set forth in the paper could exist. Then as to storage of coal. They might certainly all agree that there was a loss in storage—possibly chiefly when in the open air. But he thought that it was now generally agreed that such loss took place in the first few months, and was not a progressive loss; so that if they left coal stored for twelve months they might leave it for two or even three years without sustaining a continuing loss to anything like the same degree. Thus it became a serious question whether they had not better submit to this continuing loss (which was gradually reduced in proportion), rather than, for the purpose of minimizing the first loss, clear out the stocks and replace them with new coal every year. Mr. Stewart had very nicely defined the difference between various systems of charging retorts—namely, "layer" and "mass." This was a happy statement, and conveyed a true idea of the facts of the case. Coming to the reference to the working on the "mass" principle, it was stated that "the charge first cokes on the outside, and because of this, and also the absence of a free space, the gas passes away through the cool core of the coal, and does not suffer the breaking-down effects of the baking in an open space, as with the 'layer' system." Did the author think this occurred to any great extent in horizontal retorts? It could be understood that it was more likely to happen in vertical retorts. The excellent *résumé* given of what happened in horizontal retorts under different conditions of working, showed the author was fully competent to deal with these questions, and must have had considerable experience in various methods of carbonization. The remarks about verticals were also interesting; and they were all glad to learn that there appeared to be a really definite improvement in this system of carbonization, which theoretically was certainly the ideal one—more especially the continuous vertical process. The continuous vertical retort had always possessed a great attraction to his (Mr. Browne's) mind, because it seemed obvious that, considered from the point of view of a heat engine, it must (everything else being equal) possess a higher heat efficiency, from the mere fact that it was not charged and recharged at stated intervals. More particularly must this be the case when, as Mr. Stewart told them was now being done, regeneration was applied to the extent of making the cooling coke heat the secondary or the primary air. This would necessarily still further increase the heat efficiency of the plant. On the subject of the management of gas-works, he would like to say a word or two for the retort-house foreman. His job was really anything but an easy one. It was a job which required constant attention to many points; and while the retort-house foreman was thinking of one, he was liable to forget another which was perhaps equally important. He was a servant who should be well paid. The final matter to which he would allude was that of makes. They must all agree with Mr. Stewart's attitude with regard to the constant composition of the gas supply. His position in this matter appeared to be quite correct; for it was evident that he realized the necessity of delivering to the consumer gas of constant quality, which was free from impurities, and containing as small a percentage as possible of non-combustible, though otherwise harmless, diluents. In connection with these perfectly sound views, the author had put forward certain analyses which he (Mr. Browne) did not propose to criticize. He would prefer to show that a large percentage of nitrogen in the gas was no necessary accompaniment of a high make of gas per ton; and this he was able to do from his own personal knowledge and experience of the daily operation of a large gas-works. He was not there to say they did things in any better way at Vauxhall than elsewhere—in fact, he did not for a moment think they did—but he could tell them that the nitrogen test at the works was part of the daily routine of the laboratory. The test extended over a period of fully twenty hours, during which the sample of gas to be analyzed was collected continuously by displacement of mercury or other suitable liquid. Now, whether Mr. Stewart considered the make of 12,850 cubic feet per ton which he showed a record one or only a large make, he did not know—personally he would call it a good make—but the average quantity of nitrogen found in the gas tested under the conditions he had just named was much lower than the 10 per cent. maximum suggested in the paper, and the average make per ton bordered very closely on the figure given of 12,850 cubic feet, though it was not quite so much. He was glad the author had used the word maximum, because it suggested at once the idea of an average; and he felt certain the average nitrogen in the gas made under Mr. Stewart's supervision was considerably less than 10 per cent. In the case of the Vauxhall works, not only was the average much less than 10 per cent., but there was the very satisfactory feature about it that the variations from day to day and from week to week were trifling. That was to say, it was but a little way from being constant. He thought he might safely say the variation did not exceed 1 per cent., or certainly not more than 1½ per cent., save under exceptional circumstances, which would be at once detected and put right. In one sense, the paper might seem a long one; but it was really very short, considering the magnitude of the subject that the author had so successfully grappled with.

Mr. T. S. Lacey said that any remarks he had to make would not be in the nature of a criticism of the paper. The accepted quantity of gas per ton of coal which they might call a high make had never been, so far as he knew, fixed. Mr. Stewart evidently thought that a make of 12,850 cubic feet per ton was a very high one; whereas Mr. Browne regarded it as a good make—that was to say, that it was a quite practicable make, with good coals and under good working conditions, and that the gas would be of a satisfactory quality both from the point of illuminating power and of calorific value. Not many years ago, 10,000 cubic feet per ton was looked upon as being a fair make; and 10,400 or 10,500 feet was regarded as very high. It would no doubt be in the recollection of some there that Sir George Livesey criticized an undertaking that was making over 10,000 cubic feet per ton (at the same time that he was making considerably under), from the point of view that financially it was not successful. This was in the days when the standard of illuminating power was a high one, and the cost of enriching by cannel was heavy. Therefore he thought Sir George was justified in saying, as he did, that it was not financially desirable to try and make 10,400 or 10,500 cubic feet per ton at that time, when the necessary illuminating power could only be secured by the use of expensive enrichment. Sir George's opinion was that it was cheaper to carbonize the coal at what was then considered a moderate temperature, and get the required illuminating power out of it without using cannel as an enricher. Under the conditions then in vogue, a make of 10,500 or 10,600 cubic feet per ton did not pay. The high illuminating power that was required in those times was neither beneficial to the public nor to the gas company; and Sir George Livesey thought that the method by which gas was then being made was not one by which they could get out of the coal all the value which it might give in the form of gaseous fuel or light. That was to say, when they were restricted to 17-candle gas with the old test-burner, it was impossible to supply the public with as many B.Th.U. or as much light as they could do if they dealt with the coal in a rational way so as to give the people the best value for money. The best value for money he (Mr. Lacey) took it was primarily the largest amount of heat in the shape of B.Th.U. for whatever the price might be, accompanied by a reasonable flat-flame efficiency. Under present conditions, a consumer secured the best value for heating, cooking, and incandescent lighting; and flat-flame burners could also be used where desired. The only way in which it was possible to get the whole of the value out of the coal was obviously by reducing the illuminating power standard; and this was a point which, he thought, at last became apparent to all those concerned in gas manufacture on a large scale. If they could make 12,000 odd cubic feet of gas

per ton, with an illuminating power somewhere between 14 and 15 candles, this would be a gas which would quite easily satisfy the requirements of the consumer, both from the point of view of heat efficiency and light efficiency; and it went to prove that Sir George was quite right in the policy he adopted of lowering the illuminating power standard, because they did give people now out of a ton of coal more light and more heat than they could possibly do under the old conditions. This policy had since been adopted by most of the large undertakings; and they might say that a production of about 12,000 cubic feet per ton of 15-candle gas was the line on which most big undertakings were now working, when Durham coal was carbonized. In saying this, he was certainly not putting the illuminating power too high. Whatever might be the theoretical advantages of high or low makes, there could be no doubt that, since the reduction in the standard had taken place, and the increased makes per ton had been produced, those who had adopted the policy had shown marked progress. The "proof of the pudding was in the eating;" and the policy had been proved in practice to be the right one. He thought he had made it quite clear that he did not disapprove of the production of what some people might regard as a high make. But there was one thing he did not approve of, and that was the way in which this policy was sometimes treated. Mr. Stewart was right in saying that a meeting of the Association was not the place where they should discuss economics in detail; but he would like to say a word on this subject, because the question of the value of the extra gas was one which had been treated in a very strange manner by some people. Even the Technical Press seemed to have very vague notions on the value of the extra gas made. He had in mind the case of a provincial works where some years ago things were not particularly satisfactory, and a consulting engineer (who might or might not be alive now—he thought he was not) was called in to investigate the affairs. The engineer found there was considerable leakage in the place, in addition to other matters that did not appear satisfactory; and he said that if the 4 or 5 per cent. of gas beyond the average quantity that was being wasted by leakage could be saved, they would be in pocket to the extent of so many cubic feet at the selling price per thousand. This was a piece of arithmetic which was very popular. He would like to say what bearing the make per ton had, generally speaking, upon the cost of production. Take a company who sold gas at 30d. per 1000 cubic feet, and who, when they had done so, and paid all their expenses, loan charges, dividends, and so on, were just square. Supposing they succeeded in increasing their make by 10 per cent. This would be 3d. for every 1000 cubic feet, which they would put in their pockets. The matter was quite clear from this point of view. With an undertaking making gas under the conditions set forth, let him say that the coal cost 12·6d. per 1000 cubic feet, and residuals returned 9·6d. of this. The net cost of the coal would be 3d. per 1000 cubic feet. Supposing the coal required was reduced by 10 per cent., the cost of coal would be 11·34d., and the return from residuals would be 8·64d.—making the net cost of the coal 2·7d. per 1000 cubic feet. This was a gain of 0·3d. per 1000 cubic feet, and not 3d. as in the calculation they had before; so there was something wrong in one method or the other. He thought the last calculation was about right. But if they could make a saving of only 0·3d., or it might possibly be ½d., per 1000 cubic feet, it would, in the case cited, go to the ordinary shareholders, who might possibly receive one-tenth more dividend. If, on the other hand, they threw away even 0·1d. per 1000 cubic feet in each of the manufacturing, distribution, and other departments, these losses, though they might not aggregate 1d. per 1000 cubic feet on the expenditure, would have a vital influence on the success of the undertaking. What he wished to emphasize was that the process of gas manufacture contained a number of items of both receipts and expenditure in every department which were comparatively small per 1000 cubic feet made; and it might appear that 0·1d. did not matter. But it did matter. They had, in large undertakings, to think in one-hundredth parts of a penny. If they could not think in less than one-tenths of a penny, the Directors of the Gaslight and Coke Company would get no remuneration, because it did not amount to 0·1d. One reason why he had made these few remarks was to impress upon those concerned in gas undertakings the importance of such very small fractions as 0·1d. in each department.

Mr. S. A. Bevington (Croydon) said that, with regard to the drop of candle power in travel, they could not always be certain that they were testing the same lot of gas. They might have a particularly good or bad streak. Had the author any experience of the use of one ascension-pipe to the retort? He himself believed people often tried low seals, thinking to avoid oscillation in the hydraulic main; but if they did away with the oscillation, the heavy tars would accumulate and possibly choke up the pipe that led the tar away. The other extreme of a too high seal also possessed disadvantages.

The President believed it was still true to a large extent that dividends were made in the retort-house. He thought some of the earliest retorts were vertical; and since then, from horizontals to inclines, they had gradually come round again to the vertical. Perhaps a hundred years hence they might be carbonizing on the horizontal system again. As to the expansion of vertical retorts, this was referred to as being a little difficulty. He wondered whether it was due to the fact that the expansion took place entirely in one direction. It must have taken place also in horizontal retorts. But presumably it would then be in two directions; and thus the strain would be minimized. He noticed in regard to the analyses of tar the absence of naphthalene. It was good to know the vertical system produced less naphthalene; but why was no naphthalene shown in the tar? The author did not mention, when dealing with the question of naphthalene, the application of the reversible condenser system, which he (the President) thought was very useful. The utilization of the heat of the coke was an interesting point. Many of them who had watched the operations in a retort-house must have been disappointed at seeing huge masses of hot coke discharged, and all the heat wasted. It was stated in the paper that now the heat from the coke could be imparted to the air, and so there was an additional conservation. There must be a large quantity of heat in this coke; and he saw no reason why it should not be utilized. With regard to constant composition of gas, this was important; and it was gratifying to know it was being dealt with successfully. They not only required constant quality but constant specific gravity. When they recognized the methods of using gas nowadays, this became of very little less importance than actual quality. Looking into the figures, he found that the total heat units of the gas produced were 8 per cent. more with the high makes than with the low.

Time was too short to allow the author to reply to the discussion at the meeting; but it was arranged that he should forward his notes for publication. This he has since done. Before dispersing, the members accorded Mr. Stewart a hearty vote of thanks for his paper, on the proposition of Mr. D. J. Winslow, seconded by Mr. Vanner.

Mr. Stewart has sent the following replies to some of the questions raised in the discussion: The first point to which I must give attention is that by Mr. Browne, in reference to the mixing of coal and carburetted water gas. The statement was loosely made, as, of course, by the ordinary diffusion of gases a mixture always tends to become more intimate. The real cause of the fluctuations of illuminating power is the imperfect mixture at the start—the difficulties of mixing being mentioned by Mr. Cross. I quite agree with Mr. Canning's remarks about the condemnation of "doubtful" makes, without being aware of the conditions. Indeed, I consider a knowledge of all the details most necessary before passing judgment upon anything. The coke calorific tests were carried out with a Mahler bomb; and I should say they were accurate to 2 per cent. In answer to Mr. Vanner's query *re* outside producers, it is necessary to ensure the combustion-arches being sufficiently hot to ignite the producer gas previous to admitting the secondary air. The Fiddes-Aldridge machine does not wear the bottom of the retorts at all; the reverse, if anything, taking place—viz., the wearing strips on the chain rubbing away. As to scurfing, this needs doing about every six weeks, but is easily performed by leaving the retort open for a few hours and knocking off the carbon with a bar. The water method of curing stopped pipes I have very little faith in. Mr. Burton referred to the margin of ¼ to 1 candle; but it is often necessary. The exact amount is soon found by experience, and a knowledge of conditions. Answering Mr. Hewett, the nitrogen in the analyses was estimated by the copper oxide method, which accounts for the slight variation in totalling-up. The samples were averages over the whole period of the test—some three days. Mr. Cross's experience would seem to corroborate my own, in regard to the mixing, and also inclined retort working. I cannot accept, however, his nitrogen theory, as I think that which is split up from the ammonia becomes cyanogen. In the case of the tar composition, it is often a matter of difficulty to dispose of a bad tar to the distillers; and I am of opinion that the practice of putting oil-tar in the hydraulic main may lead to still further trouble in this direction. Of course, so much depends on the local conditions, and the quantity there is for disposal. I must express my appreciation of, and agreement with, Mr. Browne's remarks, and am particularly glad to hear his defence of foremen. The continuous vertical undoubtedly does save heat, and from a scientific point of view is a great advance. As to Mr. Bevington's query regarding the number of ascension-pipes, if one will do the work without trouble I prefer it; but, if not, two are better. Mr. Lacey has mentioned the importance of saving the small costs; and really good carbonizing, to my mind, consists in saving all waste and getting the maximum return for the minimum outlay, and a maximum efficiency from the coal, irrespective of the make. Mr. Clark appreciates the constant composition proposition; and I feel sure his hope will be accomplished in the near future.

Scottish Junior Gas Association (Western District).—At the monthly meeting of the Western District division of the Association in Glasgow next Saturday, a paper will be read by Mr. J. Wilson, of Falkirk, on "Electricity in a Gas-Works;" and a short address will be delivered by Mr. W. B. M'Lusky, of Perth.

Professor Lewes on the Carbonization of Coal.—At the Royal Society of Arts last night, Professor Vivian B. Lewes, F.I.C., F.C.S., gave the first of a series of four Cantor Lectures which he had been announced to deliver on "The Carbonization of Coal." The Lecturer dealt with the composition of coal, and referred to the existing theories on the subject and the chemistry of its formation. He explained the classification of coals, and the effect of their composition on the products of decomposition by heat. A report of the lecture will appear next week.

VERTICAL RETORTS AT GRANTON GAS-WORKS.

Important Report by the Gas Engineer.

At the Meeting of the Works Committee of the Edinburgh and Leith Corporations' Gas Commissioners on the 11th of September, the Gas Engineer and Manager (Mr. Alexander Masterton) presented a report on the vertical retorts at the Granton Gas-Works. After its consideration, the Committee decided that the Engineer should submit a statement "contrasting in all respects the vertical retorts with the inclined retorts presently in use." In accordance with this decision, Mr. Masterton submitted, in a report dated the 28th ult., the following information on the constructional and other costs.

CONSTRUCTIONAL COSTS.

The expense of erecting the vertical retort-bench at Granton amounted to £148 per ton of coal carbonized; and the corresponding cost for the inclined retort-bench there to £102 per ton of coal carbonized. In the former case, however, work is included which, in the event of any extension of the bench, would form a part of the larger installation. For instance, the gas producer and the furnace are of sufficient capacity to provide for a plant many times greater than that which at present exists. A quantity of the structural steelwork, as well as certain of the mechanical parts, would likewise be applicable to an extension of the bench; so that, in the event of further retort power being laid down on this system, the cost per ton of coal carbonized would be considerably reduced.

On comparing the above figure with that of the verticals installed in other towns, we find, from the published reports, that the Woodall-Duckham system at Nine Elms amounted to £184 per ton of coal carbonized; the Dessau system at Sunderland, to £179; and the Glover-West at Manchester, to £180.

COST OF REPAIRS.

Referring to the cost of repairs, no figures have yet been published for the installations referred to; nor have any of the plants been in existence a sufficiently long period to give any true or reliable data under this heading.

WORKING COSTS.

With regard to the working costs, Sunderland is the only town in Britain where an installation of verticals on a large working scale is in existence; and the carbonizing costs there, comprising the same items as the Edinburgh inclined retort-benches, amount to 0·57d. per 1000 cubic feet, as compared with 0·97d. on the Granton inclines.

The working costs of the Granton verticals have amounted to 1·58d. per 1000 cubic feet. But this high figure is owing to the fact that the men employed at this work would be capable of attending to a much larger plant if it were in existence; and it will be readily understood that it is impossible to employ less than one man.

In conclusion, I think it only right to point out that the vertical installation at Granton which the Commissioners authorized to be erected in June, 1909, was in the nature of an experiment, in order that valuable data might be obtained and experience gained with what was at that time a comparatively new system; so that, when any extension of the producing plant at Granton might be required, the Commissioners would be in a position to determine whether their existing type of plant was the best or whether it could be improved upon by a more up-to-date and economical system.

The following is the report of Sept. 2, referred to above.

Edinburgh, Sept. 2, 1911.

To the Right Honourable the Lord Provost,
the Convener, and other Members of the Works Committee.

My Lord and Gentlemen,—Adverting to my report dated Feb. 3, 1911, on the working of the vertical retorts at the Granton works, which was considered at a meeting of the Commissioners held on Feb. 27, 1911, when by their minute of that date the matter was delayed until the expiry of twelve months' experiments, when a further report was to be prepared and submitted, I have pleasure in stating that these retorts were first started on May 17, 1910, and continued in operation until the beginning of March, 1911. They were then let down owing to the inclined retorts, with which they work in conjunction, being put out of action for repairs, and also owing to the decreasing demand for gas at this season of the year. The section and the verticals were again put to work in June, 1911, and are still under fire.

The following figures show the record of the average working results of the vertical plant as compared with the inclined:—

—	Coal Carbonized.	Gas Made.	Average per Ton.	Coke Made per Ton.	Illuminating Power.
	Tons. Cwt.	Cubic Feet.	Cubic Feet.	Cwt.	Candles.
Verticals .	5,107 16	56,332,000	11,029	13·50	12·47
Inclines .	190,765 0	2,050,346,000	10,748	12·64	17·05

These figures bear out the conclusions in my report of February last, wherein it is mentioned that the yield of gas per ton of coal is greater than with inclines, but the illuminating power is not quite so high.

As far as ammoniacal products are concerned, the yield, estimated as sulphate of ammonia, is 20 per cent. more than on the inclined system, equivalent to 7d. per ton of coal carbonized. The coke is superior, both in quality and production; and while the tar is not greater in quantity, it is practically free from carbon, and in this respect is better than the ordinary coal-gas tar, which contains this element to a considerable extent.

For the further information of the Commissioners, I embody alongside of the Granton figures a tabulated statement compiled from published results of the working of different systems of vertical retorts in operation in England and on the Continent, and from which the Commissioners will be enabled to gauge the relative efficiency of the Granton works design as compared with other types.

(Signed) ALEXANDER MASTERTON,
Engineer and Manager.

Working Results of Vertical Retort Installations in England and the Continent, Extracted from Published Records and Compared with Granton Figures.

[With the exception of the items marked thus * all the results were obtained working without steam.]

—	Woodall-Duckham.	Dessau.		Glover-West.		Dessau.	Granton.		Glasgow.
	Nine Elms, London, Oct., 1907.	Mariendorf, May, 1908.	Sunderland, March, 1911.	St. Helens, March, 1909.	Manchester, A and B Tests Mean. No date given.	Cologne, 1909–10–11. Three Years.	1910 and 1911. Ordinary Coal.	June 20 to July 12, 1911. Whole Seam.	1910.
Duration of test	3 days	5 days	12 months	3 days	About 2 days	75 tests	12 months	3 weeks	..
Number of retorts and beds working	8—2 beds	84—7 beds	60—6 beds	8—1 bed	16—2 beds	240—24 beds	6—1 bed	6—1 bed	4—1 bed
Charges worked off in . . . hours	Continuous	10·5	12 hours*	Continuous	Continuous	12 hours*	Continuous	Continuous	See Note
Coal charged per 24 hours per retort	35 cwt.	25·6 cwt.	19 cwt.	51 cwt.	57 cwt.	..	70 cwt.	60 cwt.	
Gas made per ton of coal . cub. ft.	12,633	10,622	12,647	11,779	12,921	11,542	11,029	12,980	
Coke obtained per ton of coal cwt.	..	14·81	11·25	14·34	13·34	..	13·50	12·75	
Illuminating power . . candles	15·82	16·10	15·52	15·74	16·25	..	12·47	16·90	
Calorific value, gross . . B.Th.U.	594	594	590	600	563	..	532	582	
" " net . . "	526	532	531	542	506	572	481	527	

* Steaming two hours in twelve-hour charges.

Note.—There has been an experimental vertical setting in Glasgow, consisting of one bed of four retorts, for some time; but no results have been published. It has been decided to erect a plant containing 144 retorts in twenty-four beds.

Institution of Water Engineers.

As readers may remember, the organization established in 1896 as the British Association of Water-Works Engineers has lately been incorporated under the title of the Institution of Water Engineers; and the first (winter) general meeting will be held in the rooms of the Geological Society, Burlington House, W., on the 8th and 9th prox., under the presidency of Mr. Edward Sandeman, M.Inst.C.E. According to the programme issued by the Secretary (Mr. Percy Griffith), there will be three papers: "Water-Works Management," by Messrs. Easton Devonshire and William Matthews; "Portland Cement on Public Works," by Mr. G. Thornhill Edwards; and "New Water-Works for Skegness," by Mr. Percy Griffith. A report on "Future Water Legislation and the Position of the Institution in Regard Thereto," prepared by the Water Areas and Statistics Committee, and approved by the Council, will be read, and, after discussion, submitted for adoption. The Committee have also reported on the National Insurance Bill as it affects water authorities. A special meeting will be held before the general meeting, for the purpose of formally dissolving the old Association.

REGISTER OF PATENTS.

Purification of Gas.

WILTON, G., of Mark Lane, E.C.

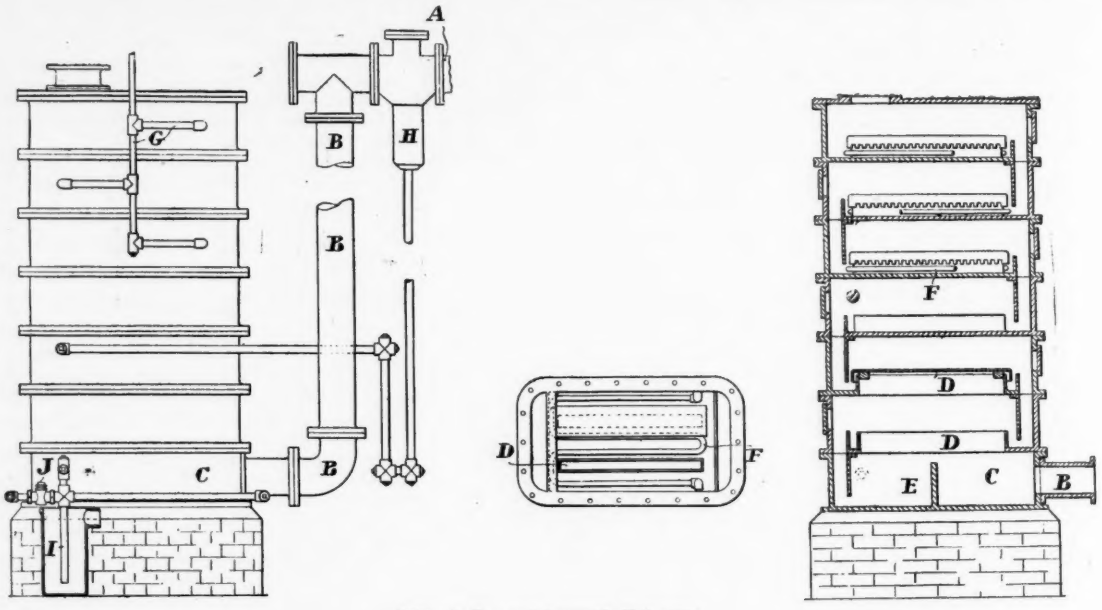
No. 18,176; July 30, 1910. No. 24,035; Oct. 17, 1910.

This combined invention relates to the treatment of gas obtained by the carbonization of coal; and its object is to remove tarry impurities, water, and ammonia from the gas "in an efficient and economical manner, and to accomplish the whole or the greater part of the treatment in one apparatus, or in one type of apparatus, so as to enable the greater part or the whole of the usual condensing and washing plant to be dispensed with."

The hot crude gas from the hydraulic or foul main is led through an apparatus in contact with gas liquor and tar condensed from the gas and passing in the opposite direction through the apparatus. The liquor and constituents deposited are cooled at or towards the gas-outlet end of the apparatus, so that this part will act as a condenser and "cause the gas to deposit its water and tarry impurities and ammonia and pass off in a cooled state; the cooled liquor passing on in contact with the hot gas through a non-cooled portion of the apparatus at and towards the gas entry, whereby the light benzols and hydrocarbons and ammonia which have been deposited by the gas at the cooler end are again vaporized and carried forward with the gas." Although (the patentee adds) some of these light benzols, hydrocarbons, and ammonia will again be thrown down by the condensing action of the cooler part of the apparatus as the gas passes on through it, a point is reached at which only a certain percentage thus again condenses, while the remainder passes on with the gas.

As a further part of the invention, the gas—preferably at or towards the gas-outlet end of the apparatus—is caused to pass or bubble through paraffin oil or other naphthalene solvent (for instance, water-gas tar) for the purpose of absorbing naphthalene and the last trace of tar from the gas. The paraffin passes on with the liquor and tar deposited from the gas, and any light benzols or ammonia which it may absorb would be again recovered by volatilization where it comes into contact with the hot gas.

The illustrations are an elevation of the apparatus, a vertical section



Wilton's Tar and Ammonia Extractor.

of the superposed system of trays, and a plan view showing the cooling pipes.

A is the foul main from which the hot crude gas is led by a pipe B to a gas-chamber C at the bottom of a series of superimposed trays formed with elongated gas-passages D with raised edges covered by serrated hoods, which cause the ascending gas to bubble through the liquor in the trays as described in patent No. 24,832 of 1901. There are the overflow connections through which the liquor descends from tray to tray in the opposite direction to the gas; and there is a partition dividing the bottom compartment into the gas-chamber C on the gas-inlet side, and a liquor-chamber E on the liquor outlet side—the overflow from the tray next above depending into the liquor-chamber.

F are cooling pipes disposed in the three upper trays along and around the bubbling hoods and supplied with a circulation of cold water by the pipe G in such manner as to keep the liquor and constituents deposited on these trays so cool towards the gas-outlet that this part of the apparatus will act as a condenser—the cooled liquor passing down in contact with the hot gas through the other uncooled trays towards the gas-inlet end, so that light benzols and hydrocarbons deposited in the cooled trays will be again vaporized, as described.

Tar or tar and liquor which may have previously separated from the gas before its admission to the trays may be collected and admitted to the trays at any desired point of their height. The illustrations show a catch-box H in the foul main, with a pipe to admit the tar and liquor to the fifth tray from the top.

I is the outlet pipe for the liquor and tarry matters overflowing from E. This pipe dips into a seal-pit, from which the liquor and tarry matters are led off at the top; while a drainage pipe leads from the gas-chamber C to the seal-pit. A pipe for draining the liquor-chamber is connected to the pipe I so that the liquor and tarry matters from E can be drained into the seal-pit by opening the valve J.

The apparatus may be started with a quantity of cold water or gas liquor run into the trays. The hot gas rising through the series of trays is efficiently cooled and washed—water, tarry impurities, and ammonia being removed, and descending through the trays to the bottom. The liquor deposited from the gas serves for the continued operation of the apparatus; being returned to other suitable part of the apparatus after treatment with alkali if desired. Only the trays towards the gas-outlet end will be cooled, in order to secure the result before described of revolatilizing at the gas-inlet end the benzols and light hydrocarbons and ammonia which may be condensed.

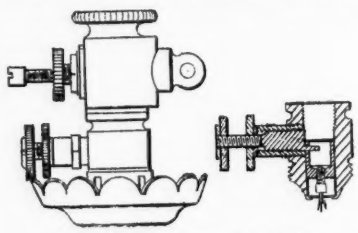
Gas-Burners.

PROSSER, H. R., of King's Heath, Worcestershire.

No. 22,891; Oct. 4, 1910.

This incandescent gas-burner regulator is operated by a crank on a rotatable member arranged transversely of the gas-supply pipe. The rotatable member screwed into a threaded hole in the carrier boss, is provided with means which may be released during the actuation of the regulator and readily brought into operation after each process of regulation "to effect a joint between the screw threads and thereby effectually prevent leakage."

The leakage preventing means may comprise (as shown) a lock-nut screwed on the threaded body of the crank. It is relatively of large diameter, so that it can be readily tightened up by the fingers. The arrangement, in conjunction with the screw connection of the body and the boss, further provides for the regulator being firmly locked in any



Prosser's Gas-Burner Regulator.

desired position. A sealing washer, interposed between the lock-nut and the carrier boss, forms an additional security against leakage. The face of the carrier boss may be coned, and the adjacent face of the lock-nut may also be coned; so that when the lock-nut is screwed towards the face of the carrier boss, the sealing washer is compressed between the two cone surfaces and forced inwards to form a joint around the screw-thread of the rotatable member in addition to forming a joint on the face of the carrier boss. Thus no leakage can possibly occur in any direction, "even after prolonged use, as there is no packing to become hardened under the action of heat."

Annealing and Retort Furnaces.

ZEUGIN, J., of Pratteln, Switzerland.

No. 23,272; Oct. 7, 1910.

This invention relates to a furnace which can be employed for annealing, hardening, and case hardening, "as well as for the production of coal gas in retorts." It is an improvement on furnaces of the type in which the generated combustion gases are ignited by the introduction of heated secondary air to the combustion chamber. Before they are carried into the chimney, the gases first sweep around the built-in retorts; in other cases, around a built-in muffle or through a

hardening chamber. They are then drawn through a number o tortuous flues below the combustion chamber; the secondary air serving for igniting, and for completely consuming, the combustion gases (likewise circulating in tortuous flue-like passages, and being preliminarily heated). In order that any desired temperature may be constantly maintained, the furnace is provided with an adjustable regulating device on the slag-door and on the chimney.

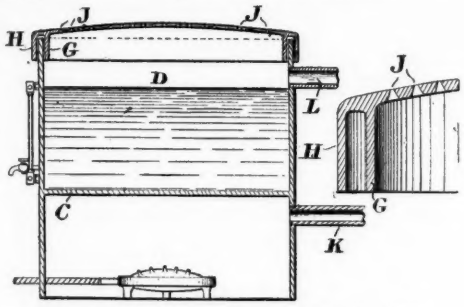
Two forms of the invention are illustrated in the specification—(1) a transverse and longitudinal section of an annealing and hardening furnace, with a semi-circular built-in muffle; (2) sections of a hardening and case hardening furnace, in which the gases circulate in the hardening chamber.

Gas Warming and Ventilating Stoves.

RUSSELL, W. J., of Wallington, Surrey.

No. 23,696; Oct 12, 1910.

This invention consists in means whereby cold air, drawn from outside a room, may be passed over heated water and thence through perforated plates before being discharged into the room.



Russell's Warming and Ventilating Gas-Stove.

The stove shown has a partition C, forming the bottom of a chamber D, adapted to contain water. It is closed at top by a lid provided with a depending concentric flange G, between which and the outer flange H a recess is formed to receive the edge of the casing—thus forming a tight joint and preventing any steam which may be condensed from running down the outside of the casing. The lid has a plurality of frusto-conical apertures J, to admit of the escape of the moisture-laden air. Such frusto-conical apertures, it has been found, "give the best result for the discharge of the humidified air due to the slight rise of pressure occasioned by the shape of such apertures."

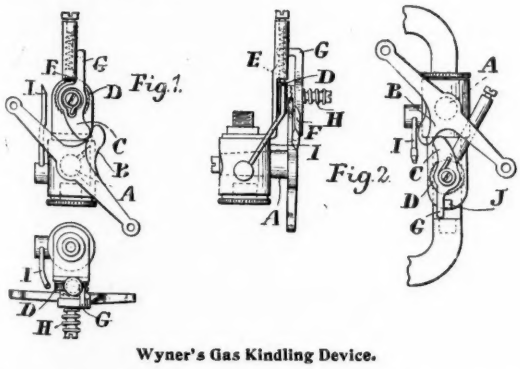
Upon the burner being ignited, the water in the chamber D becomes heated, and fumes and the waste products of combustion pass out through the flue K to a chimney-shaft. The cold air drawn from outside, upon passing over the water, becomes heated and humidified, and then escapes through the apertures J into the room. In the event of the air being drawn direct from the room, the pipes L will, of course, be omitted.

Gas Kindling Devices.

WYNER, A., of Vienna.

No. 9533; April 19, 1911. Date claimed under International Convention, Nov. 11, 1910.

Gas kindling devices are, the patentee remarks, already known in which, on opening the gas-cock, a spring-controlled lever is rotated, and (when released) rotates a friction wheel by means of a clutch acting in one direction; the wheel, in passing quickly over a fixed pyrophorus piece of metal, producing a spark for forming a flame which kindles the gas issuing from the burner. The present invention has for its object to obviate certain defect in such apparatus by providing a fixed stop for the lever operating the friction wheel; the lever being normally pressed against the stop by a spring and forced back when the kindling has been effected. Thus it not only always remains in the path of the arm on the cock plug which operates it, but also invariably assumes the correct operative position, "so that it is impossible for the mechanical device to fail."



Wyner's Gas Kindling Device.

Fig. 1 is a front elevation, side elevation, and plan of the device adapted for upright incandescent burners. Fig. 2 shows the arrangement for inverted burners.

The gas plug A is provided on one side with a two-armed lever, in the middle of which a somewhat shorter arm B is provided with a chamfered face, the length of which is such that, when displaced, it is able to operate an arm C mounted on a pivot above the cock plug. This pivot (arranged on an angular lug secured to the upper external thread of the burner) also carries the friction wheel D, against which the pyrophorus metallic part E contained in a small tube is constantly pressed by a helical spring. The arm C comprises an inclined face F and an angular nose G, which, under the influence of a spring mounted on the cock plug pivot, is constantly pressed against the tube—one end of the spring H being connected with the pivot and the other end with the arm C. On its hub, the arm carries one-half of a claw clutch, the other half of which is mounted on the friction wheel D. The pressure of the spring thus produces constant engagement between the clutch members. The spring is therefore both a compression spring and a torsion spring, and permits the rotation and also axial displacement of the arm C G operating the friction wheel.

The operation is as follows: If the left-hand side of the plug cock lever is drawn downwards, the arm C is displaced towards the left-hand by the projection B, the clutch teeth sliding over each other until the arm C is released, at which moment the latter springs back under the influence of the spring H, the friction wheel is rotated, and a spark produced, which kindles the gas issuing at the tube I, and thus lights the main flame and is shut off when the cock has been completely rotated.

If the plug A is turned back to the position illustrated, the inclined faces slide one on the other, so that the lever C, together with the coupling member connected to it, is slightly pressed back in an axial direction; but as soon as this action ceases, the arm returns to its original position by means of the spring H.

For inverted burners (as fig. 2), the kindling flame is directed downwards, so that it passes through the bye-pass hole in the globe and thus kindles the main flame. In this construction, a separate stop J is provided. The device illustrated in fig. 2 enables the kindling arrangement to be inserted in a lateral cranking K of the gas-supply pipe, so that it is removed from the path of the hot current.

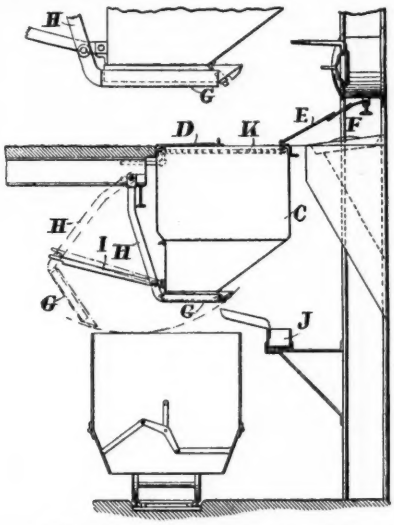
Coke Quenching Apparatus.

M'DONALD, D., of Louisville, U.S.A.

No. 13,518; June 6, 1911.

This invention relates to the handling of coke discharged from retorts into temporary containers in which the hot coke is quenched by the admission of water.

Such temporary containers or receivers are, the patentee points out, usually placed in the floor immediately in front of the bench of retorts; and the coke, when quenched, is discharged through the bottom of the containers into cars or upon a conveyor in the cellar of the coke-house, below the floor which supports the container. The steam generated in the quenching is discharged mainly through the open tops of the containers, above the floor; and it is desirable that as little steam as possible shall escape into the cellar. It is also especially undesirable that air shall be admitted to the hot coke in the temporary container, as "the coke is thereby kept in combustion and is consumed, while the heat which is thereby generated soon destroys the containers." It is the object of this invention to provide for the containers in which the hot coke is quenched practically water-sealed doors, which can be opened and closed readily and without interference with any of the operations carried on in the cellar.



M'Donald's Coke Quenching Apparatus.

The illustration shows (partly in elevation and partly in vertical section) a portion of a bench of retorts, one of the containers supported by the floor below the bench of retorts, and the water-sealed door with its appurtenances—the car into which the quenched coke is discharged being also shown. Also (on a larger scale) the details of the door.

In the floor in front of each vertical series of retorts is supported a temporary container or receiver C, into which the coke is discharged. The open top of each container is closed by doors D E; the latter being shown as adapted to be supported at F, to direct the coke into the container. The lower part of each container is preferably built with converging walls to form a shoot, with a comparatively narrow mouth, through which the coke, when quenched, may be discharged into the car or upon the conveyor below. A door G, having vertical walls forming a pan, is supported below the mouth of the container, so

that its vertical flange shall surround the lip of the mouth of the container. When filled with water, and supported in the position shown in full lines, the pan G forms a water-sealed door for the container, preventing the escape of steam and the ingress of air. The door is so formed that it may be swung away from the container to permit the discharge of the quenched coke; and for this purpose it is supported by a lever H, which is pivoted, preferably above the lower edge of the mouth, whereby the door may be swung entirely away from the mouth of the container (as indicated by dotted lines), so as to permit the free discharge of the coke, without striking the car or conveyor below. A pivoted latch I engages a stud on the lever H to hold the door either in the closed or open position. The pan G has a spout, through which excess of water flows into a drip-pan and thence into the trough J, which is common to all the containers.

Manufacture of Incandescent Mantles.

MÜLLER, A., of Berlin.

No. 11,904; May 17, 1911. Date claimed under International Convention, Nov. 12, 1910.

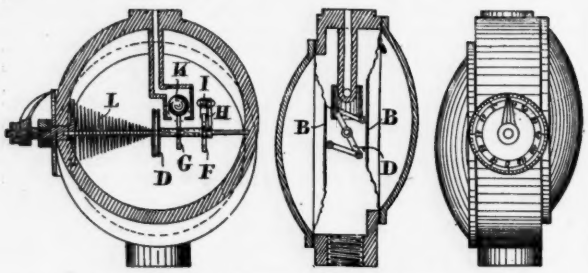
The patentee describes a method of manufacturing incandescent artificial silk mantles by precipitating thorium and cerium oxides by means of organic bases with the addition of bases containing at least two united nitrogen atoms. The mantles to be treated are first impregnated with thorium nitrate; the impregnation with cerium nitrate being effected simultaneously with the precipitation of the thorium hydroxide. After the thorium mantles have been in the base bath for about half-an-hour, they are wrung out in such a manner that the exact quantity of cerium nitrate necessary for every incandescent mantle remains, together with the bath liquid, on the filaments. The mantles are thereupon dried without washing and burned off in the usual manner. The skeletons are then said to "exhibit considerable toughness and resistibility."

Lighting and Extinguishing Gas-Lamps by Variations in Pressure.

WAGNER, F., of Cassel, Germany.

No. 17,257; July 28, 1911.

According to this invention two diaphragms are employed, both of which are connected by links to a double-armed lever rigidly mounted on a shaft, which is thus rocked by the joint movement of the diaphragms at the increase and decrease of the pressure and acts by means of ratchet mechanism on a star-wheel, which thereby alternately opens and releases a drop-valve.



Wagner's Lamp Lighting and Extinguishing Device.

In the casing shown, two diaphragms B are arranged so as to move apart from and approach one another in accordance with the variations of the pressure in the service gas-pipe. The diaphragms are connected by links to opposite ends of a double-armed lever D, which is rigidly mounted on a rock shaft. Loosely arranged on the shaft are a star-wheel G and a ratchet-wheel F—both interconnected by a sleeve fitted loosely on the shaft. A pawl I, working on the teeth of the wheel F, is pivoted to an arm H, rigidly connected to the shaft. The star-wheel is disposed underneath a drop-valve K, and is so arranged as to engage the valve with its teeth for opening it and admitting gas to the lamp. A spiral spring L acts on the shaft and tends to turn the elements in opposition to the pressure.

When the pressure is increased, the diaphragms will be forced apart, in opposition to the spring; the shaft being thereby turned so as to retract the pawl by one tooth. At the subsequent decrease of the pressure, the spring acts on the shaft so as to bring the diaphragms back to their initial position. At the same time the wheel F will be turned by the pawl I through one tooth space. The star-wheel G has only half as many teeth as the ratchet-wheel, and is therefore set alternately, by each operation, to light and extinguish the lamp. The spring has one of its ends connected to a disc on a shaft which is passed to the outside of the casing and which may be turned for varying the tension of the spring and thus the resistance it offers to the gas pressure. The pointer N indicates on a scale the pressure at which the apparatus is caused to work.

Gas-Generators.

KUNZE, E. A., of Aussig, Bohemia.

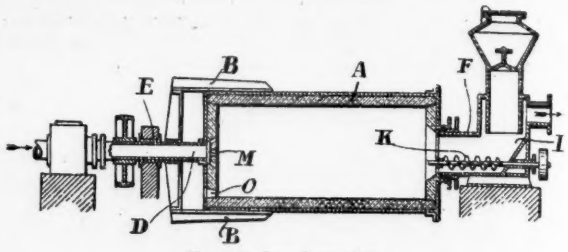
No. 14,767; June 21, 1911.

This gas-producing plant is of the kind in which coal dust is delivered into a horizontally arranged rotatable cylinder in which it is fired, and from which the gases generated are conveyed away for consumption.

Such cylinders have been used in conjunction with screw-conveyors, which deliver the coal into them at one end—the gas passing out at the same end; while the air is introduced at the other.

The inventor employs this type of cylinder; and the novel feature of his apparatus is that he conducts the air through a shaft or pipe arranged in a bearing, and which (preferably through bracket-like arms) acts as a support for that end of the cylinder while the other end is sealed with a stuffing-box around the duct or passage through which the coal is introduced and the gas passes.

This construction is said to permit of the rapid rotation of the cylinder, and the consequent better distribution of the coal dust through it, as compared with slowly rotating cylinders in which the dust is liable to pile up and not get thoroughly burnt. In the rapid rotation the coal dust is raised to the highest point inside the cylinder, whence it falls in a finely distributed manner through the entire section of the cylinder; and a current of air introduced at one end of the cylinder passing through it completely delivers its oxygen into the front or delivery end of the cylinder. Thus the coal particles are all ignited; and the whole cross sectional area of the cylinder is filled with the "glowing particles of coal and a highly satisfactory gas, consisting of nitrogen, carbon monoxide, carbon dioxide, hydrogen, and carburetted hydrogen, is produced."



Kunze's Gas-Generator.

An example of the invention is here shown diagrammatically; the cylinder being in vertical section.

The cylinder A (of sheet iron and lined with fire-clay) is supported at one end on a hollow air-shaft D by arms B. The air-shaft is supported in the bearing E, while the other (gas outlet) end of the cylinder is fitted to a turned socket F, in which it is rendered gas-tight by a stuffing box and packing (asbestos lubricated with graphite). The socket has connected to it a coal-dust inlet passage I, within which a conveyor K is fitted in such a manner that the coal dust introduced from the hopper above is evenly conveyed into the cylinder. The hollow air-shaft D terminates at the multi-inlet nozzles M made in the detachable end cover of the cylinder; the effect of the nozzles being to produce a distributed permanent current of air through the interior of the cylinder. A cleaning or slag hole O delivers automatically (with a small amount of air) the slag or dross out of the cylinder, while the front or delivery end is maintained at red heat. The gas passing out is indicated by the arrow near the hopper ready for use. It has a temperature of (say) 300° to 400° C.

APPLICATIONS FOR LETTERS PATENT.

25,264.—MENGERS, O., LANGE, K., and LENTSCHAT, E., "Gas-burners." Nov. 13.

25,297.—WEISS, O., "Air-gas plant." Nov. 14.

25,334.—HARSANT, H., and MITCHELITE PETROL AIR-GAS SYSTEM COMPANY, LTD., "Manufacture of petrol gas." Nov. 14.

25,341.—GIBBONS, F. J. J., and GOUGH, R., "Gas cooking-stoves." Nov. 14.

25,367.—CARPENTER, C. C., "Gas-lamps." Nov. 14.

25,380.—FAZI, R. DE, "Production of combustible gas." Nov. 14.

25,442.—BERLINER, E., "Rotary gas-engines." Nov. 15.

25,454.—FRITZSCHE, P., "Separation of sulphur from sulphuretted hydrogen and gases containing the same." Nov. 15.

25,458.—SPROTT, E. W., "Gas-burners." Nov. 15.

25,460.—HAM, C. G., "Pressure-reducing valves." Nov. 15.

25,472.—SCHWANKE, P., "Locking cocks or taps." Nov. 15.

25,476.—BARRALET, J. H., "Water-heaters." Nov. 15.

25,576.—HUTTENLOCHER, F., "Gas-burners." Nov. 16.

25,587.—CAMBRIDGE SCIENTIFIC INSTRUMENT COMPANY, LTD., and WHIPPLE, R. S., "Calorimeters." Nov. 16.

25,608.—HUMARAN, F. G., "Production of explosive mixtures for driving gas-turbines, compressors, and pumps." Nov. 16.

25,642.—AULD, D., AND SONS, LTD., AULD, J., and GRAHAM, J., "Pressure-reducing valves." Nov. 17.

25,684.—MARISCHKA, C., "Combined steam and gas generator." Nov. 17.

25,690.—HUESSENER, K., "Driving contrivance for coke-rams." Nov. 17.

25,701.—CARPENTER, C. C., "Incandescent lamps." Nov. 17.

25,736.—CLIMIE, W., "Gas-producers." Nov. 18.

25,764.—LIVERSEDGE, H. T., "Rotary engines applicable as pumps, compressors, or meters." Nov. 18.

25,768.—BAXTER, A., "Cock or valve." Nov. 18.

25,770.—OLSO LICHT GES., HALBMAYR AND CO., "Automatically sealing gas-pipes." Nov. 18

25,781.—MIREAU, E., "Gas-purifiers and savers for gas-stove burners." Nov. 18.

25,812.—HELPS, G., "Incandescent burners." Nov. 18.

Objection to Tar-Sprayed Roads.—Speaking at a meeting of the recently formed Road Protection Association for Lancashire, held at Preston last Thursday night, Mr. E. G. Hothersall, of Preston, said that though he had tips on the foreshoes and rubber heels on the hind feet of his horses, it took them all their time to keep their feet on tar-sprayed roads. This, he submitted, showed that the roads were hardly passable; and he said there had been quite a number of accidents to horse users through the tar-sprayed roads. A resolution was adopted asking the County Council to endeavour to get a method of suppressing dust which would leave the roads safe to horse users.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Sunday Labour Question.

SIR,—During the month of October last, some 1600 circulars were sent out, under my name, to the various gas-works in the country, asking a few plain questions on the above subject; and I shall highly esteem it if you will kindly grant me space to thank those 460 engineers, managers, and others, who have, up to date, favoured me with replies; and at the same time to press those who have not yet replied to assist me by so doing.

I may here state that it is intended to classify and tabulate the replies received in such a manner as to render the identity of any person or individual undertaking impossible; and that I hope to find a suitable place for them in my official utterances in June next.

While on so cognate a subject, may I also suggest to prospective contributors of papers and other communications to the next annual meetings of the Institution, that an *early intimation* of their desire, either to the Institution Secretary (Mr. W. T. Dunn) or myself, will greatly assist in the preparatory work for those meetings.

R. G. SHADBOLT,
President, Institution of Gas Engineers.

Grantham, Nov. 27, 1911.

South Metropolitan Gas Workmen and the Insurance Bill.

SIR,—In view of the present position of our mutual sick fund under the National Insurance Bill, and the action of the Government in refusing exemption to such funds where every safeguard can be provided, and benefits guaranteed equal, if not superior, to those under the Bill, may we ask you to give publicity to the enclosed copy of a letter which has been forwarded to the Home Secretary?

W. A. BARNETT,
Secretary of the Workmen's Committee.

709, Old Kent Road, S.E., Nov. 27, 1911.

[ENCLOSURE.]

The Right Hon. Reginald M'Kenna, M.P.,
Secretary of State for the Home Department.

Dear Sir,—As the members of the above Committee who formed the deputation which you were pleased to receive at the House of Commons on Thursday evening, November 16, we fail to understand your statement in the House on the debate on Schedule I., Part II., Exceptions—Sir Henry Kimber's amendment to the Chancellor of the Exchequer's amendment—that we "were not in the least aware of the value of the provisions of the Bill, and I left them under the impression—perhaps an erroneous one—that after the discussion they were not so very anxious to be left out of the Bill."

We most emphatically stated that we were not satisfied with your statement that we would be better off under the Bill, and could not understand why, the principle of exemption being granted in the case of railway companies' employees, a large Company such as our own should not be allowed to agree with their employees upon a mutual scheme. All other points appear to us to be matters of detail. A perfect safeguard would naturally be created by the fact that any scheme would have to secure for us, as employees, benefits at least equal to those provided under the Bill, and would, of course, need to be approved by the Insurance Commissioners, or other appointed authority, in addition to receiving the sanction of the whole of the employees of the Company; and that, in our view, the Company's guarantee of the fund's stability sufficiently met the case, and we had every confidence that the Board of Directors would not desire to shirk any responsibility that guarantee involved.

We have still strong hopes that the Government may be prevailed upon to reconsider their decision; and, in view of the principle involved in our case, we propose sending copies of this letter to the Press.

(Signed) W. A. BARNETT
H. T. MANLEY

Members of the Deputation.

South Metropolitan Gas Company's Workmen's Committee, 709, Old Kent Road, S.E., Nov. 24, 1911.

PARLIAMENTARY INTELLIGENCE.

NATIONAL INSURANCE BILL.

Case of the South Metropolitan Gas Company.

During the debate on the National Insurance Bill in Committee of the whole House on Monday of last week, the Chancellor of the Exchequer moved to add to the exceptions set forth in Part II. of the first schedule the following paragraph: "Employment as a clerk or otherwise in the service of a railway or other company, or of a joint committee of two or more such companies, when the Insurance Commissioners certify that the terms of employment are such as to secure provision in respect of sickness or disablement, on the whole, not less favourable than the corresponding benefits conferred by Part I. of this Act, and the person so employed is a member of a superannuation fund established by Act of Parliament for the benefit of persons in such employment."

Sir H. KIMBER intimated his intention of proposing a series of amendments to this amendment. He said he would first move to leave out the words "as a clerk or otherwise," and then the omission of the words "railway or other," in order that employment in any company with a fund which provided terms not less favourable than those conferred by the Bill should secure exemption from its provisions. He pointed out that there were many concerns (like the South Metropolitan Gas Company) and large firms who had established funds which gave their members much greater benefits than were conferred by the Bill. These funds were of great stability—their solvency being guaranteed by the employers; and he could not see any difference in principle between a railway company and these companies and firms, so long as their funds complied with the conditions laid down. In the case of the South Metropolitan Gas Company, the men were better off for a less subscription than they would be under the State scheme; and therefore they should be included among the exceptions.

Mr. M'KENNA remarked that the South Metropolitan Gas Company guaranteed the solvency of the fund, and had incurred a large liability. If the Company were wound up, they would have to pay the whole of this outstanding liability. Under clause 19 [special provisions for employers' superannuation funds, &c], the employers would not have a greater liability. They could go on guaranteeing the superior advantages of their scheme. The men would have all their present advantages, and, in addition, would get maternity and sanatorium benefits, which alone were worth the extra 1d. they would have to pay. Under the Bill, and by paying 4d. a week, the men would secure greater benefits than they had at the present time. The deputation he had seen had not been acquainted with the provisions of the Bill; and he was under the impression—perhaps an erroneous one—that when they left him they were not very anxious to be left outside it. Under the Bill, and by paying 4d. a week, the men would get greater benefits than they had at the present time.

Sir H. KIMBER: The men do not think so.

Mr. M'KENNA said Parliament could not rely merely on the solvency of a private company. Gas might go out of use; and the men might find themselves left in their old age. It would be unwise to let any private firm or company stand out of the Bill. The Government must have absolute security for the men.

Mr. HAMILTON BENN said the Company's men did not wish to come under the Bill; and the State would save a considerable amount of money by leaving them out. Under these circumstances, he wished to know why they should be forced to come in. Pointing out that two-fifths of the gas undertakings in the country would not come under the Bill, because they were owned by local authorities, he asked, why should not this great commercial Company occupy a position similar to that of two-fifths of the gas industry of the country?

The SOLICITOR-GENERAL remarked that the case put forward on behalf of the South Metropolitan Gas Company might be regarded from a very simple point of view. The fund was actuarially sound or it was not. If it was not actuarially sound, then the scheme ought not to claim special exemption. There was a fundamental difference between the South Metropolitan Gas Company's scheme and that in the Bill—a difference that raised the whole question as between a sound fund actuarially and a fund likely to be in financial difficulty. By the Government scheme the contributing parties contributed *pari passu*. As benefits came to be paid, they were not paid in the first instance out of workmen's premiums, and in the second place out of employers' and State contributions. But by the South Metropolitan scheme, so long as workmen had paid in sufficient to pay the benefits, the Company paid nothing. There was the difference between a sound scheme actuarially and one that was not sound. The Company invited the workmen to contribute to a pool, and the rules governed this contribution; but when the pool ran dry, then the Company guaranteed the financial stability of the fund, making income balance expenditure every quarter. If there were sufficient contributions from the men to fill up the pool, there were no contributions from any other source. In discussing this particular case, they were likely to lose sight of the general considerations that must govern exceptions. The real principle was that here they had a national system, *prima facie* universal; but in setting it up, they found that the ground they proposed to occupy was already occupied in part by voluntary agencies. The essential conditions for the exclusion of these associations should be that the persons connected with them were in practically permanent employment; and, secondly, that the fund of which they were members should be able to meet the demands that might hereafter be made upon it. Beyond this they were not prepared to go.

Mr. W. RUTHERFORD said the damning fact about this particular Company was that their body of 6000 men had actually no trade union. What an unfortunate concern it must be! This was a Co-operative Society. Not only did the men get exceedingly good wages, but there was an annual divide of a portion of the profits. In addition, there was an absolute guarantee by the Company that if there was a penny short in meeting the benefits, they would make it good. What better security could there be? It was said there was no maternity or sanatorium benefit; but the Company proposed, before the Bill came into operation, to add to their benefits every benefit offered by it. Why, then, should they not be exempt? Why should not a gas company, run on its own account, as this one was, be exempt as well as the gas undertaking of a local authority?

Mr. BARNES said some employers started schemes with the sole object of benefiting the men in their employ; but the South Metropolitan Gas Company were not among this class. Their scheme was not started through philanthropic motives. It was started for the purpose of defeating the Gas Workers' Union; and the Company succeeded. But the Company had worked their men twelve hours a day, when some other companies of a similar kind were working their staff eight hours. The Labour Party could not look on these schemes as affecting only the men who came under their operation, because the conditions of labour imposed on these men had the effect of determining the conditions of labour elsewhere. They could not assent, therefore, to any proposal which would have the effect of isolating groups of men from their fellows engaged in similar occupations.

Mr. POLLOCK urged that the scheme of the South Metropolitan Gas Company was as actuarially sound as the most solvent institution in the country, inasmuch as it had the guarantee of the employers.

Mr. MORTON explained that, under a profit-sharing scheme, the men employed by the South Metropolitan Gas Company had £300,000 invested in the undertaking, and had three employee representatives on

the Board. In answer to the objection that the men were not unanimously in favour of being exempted from the Bill, he said he was officially informed that out of the 6000 men included in the fund, the minority against contracting-out was 27.

Mr. PETO said the men of the South Metropolitan Gas Company still thought they should be outside the provisions of the Bill. The profit-sharing system between employers and employed adopted by the Company offered the best solution of the industrial problem.

On a division, the amendment of the Chancellor of the Exchequer was agreed to, with the deletion of the word "otherwise" and the substitution of "other salaried officials."

BELFAST CORPORATION BILL (1911).

It may be remembered that the General Powers Bill promoted by the Belfast Corporation for the present session contained a clause conferring powers upon them with respect to the prices to be charged for gas, and particularly enabling them to charge for gas supplied for power and manufacturing purposes a lower rate than that charged for ordinary domestic or lighting supplies. When the Bill first came before the Local Legislation Committee on the 9th of May, there were no fewer than twenty petitions against it; but some of these were of a merely formal character. The Committee, under the chairmanship of Mr. Ernest Gardner, sat three days each week until the 1st of June. The Bill, as amended by the Committee, was read the third time in the House of Commons on the 20th of that month; and it came on the 12th of July before the Select Committee of the House of Lords, of which Lord Welby was the Chairman. The Committee concluded their deliberations on the 19th of July. The Bill had not passed through all its stages when the House rose in August for the summer recess. There was some difference between the two Houses in regard to an amendment relating to railway property. But it was settled in the Lower House last Tuesday afternoon; and the Bill now only awaits the Royal Assent. Part XII. authorizes the Corporation to supply gas for power purposes at rates lower than for lighting, and includes financial provisions regarding the borrowing of money for the requirements of the gas undertaking—such as new mains, services, and meters.

NOTICES GIVEN FOR BILLS (SESSION 1912) RELATING TO GAS, ELECTRICITY, AND WATER SUPPLY.

Annfield Plain Gas.—The Annfield Plain and District Gas Company intend to apply for authority to purchase additional land for gas-works, and for an extension of their limits of supply so as to include portions of the parishes of Iveston and Stanley; the former area to be excluded from the limits of the Shotley Bridge and Consett District Gas Company. Additional capital will be required. The Bill to be promoted will contain provisions in regard to superannuation and other allowances, and the formation of a profit-sharing scheme for the employees and workmen.

Ashborne Urban District Council (Gas).—The Ashborne Urban District Council intend to apply for power to purchase the undertaking of the Ashborne and District Gas Company, maintain and carry on the works, and supply gas within or beyond their existing limits. Provision will be made for the sale of a portion of the works outside the district. Authority to borrow the necessary money will be required.

Askern and District Gas.—Application will be made by the Askern and District Gas Company, Limited, to be dissolved and re-incorporated, with power to maintain and extend the existing works, and supply gas in Askern and other places in the West Riding of York. The Bill will contain provisions in regard to the quality, testing, and pressure of gas, its supply in bulk, and the charges to be made; and permission will be sought for the raising of more money and the creation of reserve and special purposes funds.

Bawtry and District Gas.—The Bawtry and District Gas Company, Limited, will seek to be dissolved and re-incorporated, with power to maintain the existing and construct new works, and supply gas in Bawtry and a number of places in the West Riding of York and the county of Nottingham. It is proposed to purchase the undertakings of the Gringley and Tickhill Gas Companies. Additional borrowing powers will be required.

Bawtry and Tickhill Gas and Water.—Application will be made for authority to incorporate a company for the supply of gas and water in the parish of Bawtry, the urban district of Tickhill, and the parishes of Ansterfield and Bawtry, in the West Riding of York, and a number of parishes in the county of Nottingham. It is proposed to purchase the undertakings of the Tickhill and Bawtry Gas Companies, and construct and maintain gas and water works.

Bedwellty Urban District Council.—Confirmation will be sought for an agreement entered into for the purchase by the Council of the undertaking of the New Tredegar Gas and Water Company, Limited; and application will be made for authority to supply water and gas in their district (except the portion comprised within the water limits of the Tredegar Urban District Council), and in a specified portion of the Rhymney Valley. The Council also propose to acquire the undertaking of the Blackwood Gas Company, and sell part of it to the Mynyddislwyn Urban District Council; also to purchase a portion of the water undertaking of the Rhymney and Aber Valleys Gas and Water Company, and sell to that Company the portion of the gas and water undertakings of the New Tredegar Company that lies in the urban district of Gelligaer. Additional money powers will be required.

Belfast Corporation.—Application will be made by the Belfast Corporation for further powers in respect of their gas undertaking. They wish to be authorized to purchase compulsorily certain specified lands in the county of Antrim, and use them for gas-works purposes; construct two bridges over the River Blackstaff; and amend or repeal the provisions of their Acts with respect to the illuminating power and testing of gas, and make others in regard thereto, and to the apparatus to be used for the purpose. The other objects set forth in the notice are those now generally found in Gas Bills. The Corporation will require the necessary authority for the raising of money by the creation of stock for the purposes of the Act to be applied for. Various Acts and Orders are to be amended or repealed.

Birmingham Corporation.—The notice given by the Birmingham Corporation of their intention to apply for authority to purchase certain lands for the erection of gas-works was referred to in the "JOURNAL" last week (p. 543).

Bognor Gas Company (Electricity).—The Bognor Gas Company will apply for authority to establish generating stations and works, and supply electricity within their gas limits. Separate accounts will be kept for the two illuminants. An increase of capital will be applied for. The Bill will contain all the necessary provisions incidental to the supply of electricity, both to ordinary consumers and in bulk, and the regulation of pipes and fittings.

Borden and District Gas.—It is proposed to dissolve the East Hants Gas Company and incorporate a new company with additional powers. In the Bill to be promoted, provision will be made for the maintenance and extension of the existing works, testing the quality and illuminating power of the gas, and making regulations in regard to pipes and fittings. Application will be made for the amendment of the Woolmer and Haslemere Gas Orders in so far as they affect the Company; also for authority to apply for a Provisional Order or Licence to supply electrical energy. The Bill will include provisions as to the existing capital and that which will be required.

Brodsworth and District Gas.—The Brodsworth and District Gas Company will apply to be dissolved and re-incorporated, with power to supply gas in a number of townships, parishes, and places in the West Riding of York. Authority will be sought to maintain and extend the existing gas-works, purchase the undertaking of the Askern Gas Company, and raise more capital. The Bill will contain the usual provisions incidental to the supply of gas, the testing of its quality and pressure, and the regulation of pipes and fittings.

Cannock Urban District Gas.—Application will be made by the Cannock Urban District Council for authority to purchase the undertaking of the Cannock, Hednesford, and District Gas Company, Limited; maintain, extend, and construct gas-works; and supply gas within the Company's existing limits of supply, as well as in an adjoining part of the parish of Norton-under-Cannock now within the limits of the Ogley Hay and Brownhills Gas Company, Limited. It is proposed to ask for the repeal of the Brownhills and District Gas Order, 1910, so far as it relates to the area just referred to. The Bill will contain the usual provisions in regard to the supply of gas and the levying of rates and charges. Additional borrowing powers will be required.

Christchurch Gas.—The Christchurch Gas Company intend to apply for an extension of their limits so as to include the parishes of Hordle, Milford, Milton, and Sway, in the rural district of Lymington, and part of the parish of Highcliffe, in the rural district of Christchurch, all in the county of Southampton; and to purchase land at Milton for the erection of works for the manufacture and storage of gas and residual products. Additional capital will be required. The provisions of the Company's existing Acts are to apply to the proposed extended area.

Church Stretton Water.—Application will be made by the Church Stretton Urban District Council for power to acquire the undertaking of the Church Stretton Water Company, maintain the existing works, supply water within the urban district of Church Stretton, and the civil parishes of Little Stretton and All Stretton, in the county of Salop, and make further provisions for the supply of water. Authority will be sought to raise the necessary money.

Derwent Valley Water Board.—Application will be made by the Derwent Valley Water Board for authority for the appropriation of the waters of the River Derwent for the purpose of filling the Howden and Derwent reservoirs, and also of compensation water for filling the latter reservoir. It is proposed to divert into, and impound in, that reservoir waters from the Howden reservoir and the Derwent; and the provisions of the Derwent Valley Water Acts, 1899 and 1901, with reference to compensation water and gauges are to be altered. The Board will ask for an extension of time for the purchase of certain specified lands in Derbyshire.

Dover Corporation.—In a General Purposes Bill of which the Dover Corporation have given notice, they will ask for the confirmation of any agreements they may enter into with the East Kent Water Company in regard to the rates to be charged for the supply of water within a portion of the borough.

Dunstable Gas and Water.—The Dunstable Gas and Water Company will apply for the confirmation of their existing pumping-station, wells, &c., in the parish and borough of Dunstable, and for authority to construct a new station, reservoir, and other works. The Bill will contain further provisions in connection with the gas undertaking, including the testing of the pressure and quality of gas, the charge to prepayment-meter consumers, &c. Additional capital will be required for both gas and water undertakings.

Egremont Urban District Council Water.—The Egremont Urban District Council intend to apply for power to construct works, comprising a service reservoir, an intake or settling-tank, an intercepting dam, and two aqueducts or pipe-lines, in the county of Cumberland, and supply water within and beyond their district. Authority to borrow the necessary money will be required.

Felixstowe and Walton Transfer.—Parliamentary sanction will be sought by the Felixstowe and Walton Urban District Council for the purchase by them of the undertaking of the Felixstowe and Walton Water-Works Company. The amount of purchase-money and the terms and conditions of the transfer are to be settled by arbitration in default of agreement. The Bill to be promoted will confer upon the Council power to carry on the undertaking, and to complete, maintain, improve, or discontinue the works; and will authorize them to supply water within the existing area of the Company—including the parishes of Felixstowe and Walton and certain parts of the parishes of Trimley St. Mary and Trimley St. Martin, all in the county of Suffolk—and recover the rates and charges therefor. The general provisions in connection with the supply of water will

be included in the Bill. The Council will ask to be empowered to raise the necessary money.

Fleetwood Gas.—The Fleetwood Gas Company, Limited, will apply to be dissolved and re-incorporated, with power to supply gas, and maintain the existing and construct new works; and they wish for additional capital and borrowing powers. The Bill will contain provisions in regard to the pressure, quality, and testing of gas, and the others incidental to the supply of this illuminant, and the regulation of the pipes and fittings employed in connection with it.

Fylde Water Board.—Authority will be sought by the Board for the construction of four impounding reservoirs, two service reservoirs, and a number of aqueducts, road diversions, and other works. They wish to purchase compulsorily lands within the drainage area of the River Hodder, the head-waters of which they are desirous of impounding, as well as those of the Bridge House Beck, and the Croasdale Brook. Application will be made to exempt the works from the jurisdiction of the Fishery Board. Additional borrowing powers will be required.

Gas Companies (Benefit Funds).—The proposals contained in the Bill to be introduced next session by several gas companies for the establishment of benefit funds for gas workers were noticed last week (p. 543).

Gas Companies (Standard Burner).—As mentioned in the "JOURNAL" last week, several gas companies have decided to apply next session for authority to adopt the "Metropolitan" No. 2 as the standard burner for testing the illuminating power of the gas.

Herne Bay Gas.—The Herne Bay Gas Company, Limited, purpose applying for authority to acquire further land for the manufacture and storage of gas, and also to raise additional capital. The Bill to be promoted will contain provisions for instituting a standard price and dividends, creating special purposes and reserve funds, and testing the quality of the gas. The Company is to be dissolved and re-incorporated with extended powers.

Hertford Corporation.—In a General Purposes Bill which the Hertford Corporation intend to introduce, they will ask for authority to lay pipes, mains, and apparatus, and construct works for the supply of water and electricity, in streets not dedicated to the public use.

Houghton-le-Spring Gas.—Application will be made by the Houghton-le-Spring District Gas Company for further powers, an extension of their area of supply, and authority to raise more capital, acquire additional lands, and create a special purposes fund. The Bill will contain provisions in regard to testing the quality of gas, the price to be charged, the sale of gas in bulk, &c. It is proposed to appoint a Managing-Director. The area as extended will include the parishes of East, Middle, and West Herrington, South Biddick, Bournmoor, Little Lumley, and Morton Grange, in the county of Durham.

Ivybridge Urban District Council.—Application will be made by the Council for statutory powers in respect of water supply. They wish to be authorized to maintain and use the existing works and construct others, comprising a reservoir, two aqueducts, and an approach road. The Bill will contain provisions for preventing the fouling, contamination, and waste of water, and for making and recovering rents, rates, and charges for its supply for domestic and trade purposes. Additional borrowing powers will be applied for.

Keighley Corporation.—Authority will be sought by the Keighley Corporation for the abandonment of the new Bully Trees reservoir sanctioned by their Act of 1898, the conduit or catch-water drain required by the Act of 1869, and the construction of two reservoirs, three aqueducts or pipe-lines, and a road diversion. It is proposed to alter the existing provisions in regard to compensation water. More money will be required.

Kingston-upon-Hull Corporation.—Authority will be sought by the Kingston-upon-Hull Corporation to make further provision in regard to their water undertaking and the supply of water, including the acquisition of additional lands, and to require the owners of premises to keep in repair the communication-pipes supplying such premises.

Leatherhead Gas.—The sanction of Parliament will be sought for the transfer of the whole or part of the undertaking of the Cobham Gas Company to the Leatherhead Gas and Lighting Company. The Bill will contain provisions as to the consideration to be paid for the concern, and the winding-up of the Cobham Company. The Leatherhead Company will ask for authority to supply gas in the acquired Company's area, and to exercise therein all that Company's powers and privileges. Provision will be made for testing the pressure and quality of the gas, and for dealing with separate supplies of gas and electricity. More share and loan capital are required.

Llanelly Rural District Water.—The Llanelly Rural District Council intend to apply for authority to construct two reservoirs and other works, purchase land and easements for works, appropriate the waters of certain streams, acquire a portion of the plant and works of the Llanelly Urban District Council, and supply water within part of their limits to be defined in the Bill. Provision will be made for raising the necessary money.

Mid and East Kent Water.—Application will be made by the Mid-Kent Water Company for an extension of their limits of supply, so as to include several parishes and places in the rural districts of Elham, East Ashford, Faversham, and Hollingbourne, all in the county of Kent. It is intended to ask for confirmation of the existing works and authority to construct others, comprising three pumping-stations, a similar number of service reservoirs, and five conduits or pipe-lines. The Company wish for power to acquire the Ulcomb water undertaking of the Hollingbourne Rural District Council. It is proposed that the powers conferred by the intended Act shall be exercised by the Mid Kent and East Kent Water Companies jointly, or by the latter Company solely; and confirmation will be sought for agreements relative thereto, as well as to others made between the Mid, East, and South Kent Companies with respect to a mutual supply of water. Further capital and borrowing powers will be required by the first two Companies. Provision is to be made with respect to the water-rates to be charged in part of the borough of Dover; and also for the appointment of Managing-Directors.

Salford Corporation.—The scope of the Bill of which the Salford Corporation have given notice was indicated in the "JOURNAL" last week (p. 543).

Salford Gas.—Application is to be made by the Corporation of Eccles and the Urban District Councils of Swinton and Pendlebury and Worsley, or some or one of them, to confer power upon the Salford Corporation to acquire, hold, and use certain lands for gas-works purposes. The Bill to be promoted will contain provisions in regard to the illuminating power, purity, and testing of gas, the supply of burners gratis, the abolition of the differential rate for the supply of gas to private consumers and for public lighting, and the application of the net surplus gas revenue to the reduction of the price of gas. The promoters will ask to have put upon the authorities of certain districts supplied with gas by the Corporation the obligation to contribute a share, according to the rateable value, of the moneys paid out of the rates of the borough, in the event of the gas undertaking of the Corporation becoming a total loss, and the outstanding capital becoming chargeable on the rates of the borough owing to the discontinuance of the use of gas by the public. Further borrowing powers are required.

Scunthorpe Urban District Water.—Application will be made by the Scunthorpe Urban District Council for power to construct new water-works, consisting of a pumping-station and an aqueduct, conduit, or pipe-line, acquire waters and springs, make provision to protect the water supply from depletion, prevent waste, &c. More money will be required.

Sheffield Corporation.—In a General Powers Bill of which the Sheffield Corporation have given notice, there will be a number of provisions with respect to the water undertaking. The Corporation require authority (*inter alia*) to purchase lands for the protection of their water-works, and to take other steps to preserve the purity of the water. It is proposed to confer upon persons liable to maintain pipes and apparatus the like powers of opening the ground as are conferred upon them by the Water-Works Clauses Act, 1847, for laying communication-pipes; also to empower any local or other authority wholly or partly within the limits of supply of the Corporation to guarantee such return upon the cost of affording a supply of water to any part of their district as may be necessary to enable the Corporation to afford such supply.

Shipley Urban District Council.—A General Powers Bill of which notice has been given by the Shipley Urban District Council will contain clauses relating to the gas and water undertakings. The Council will ask for authority to change the prescribed apparatus and burner for testing the gas, make further provision in regard to quality and pressure, and alter the illuminating power. The Bill will specify the period over which a meter for measuring electrical energy supplied by the Council shall be deemed to have been defective, and will define the powers and liabilities of the Council and the consumer in this respect. The other provisions relating to gas will be of the usual character. With regard to water supply, the Council will apply for authority for the compulsory acquisition of lands forming part of Morton and Bingley Moors, for the purposes of their water undertaking; and they will ask Parliament to make it obligatory upon the Bradford Corporation to sell the lands in question at the price at which they were purchased by them. The Bill will include provisions in regard to the supply of water by measure; the term "domestic purposes" will be defined; and the Council will apply for power to cut off the water if it is improperly used. Authority will be sought to raise money for the purposes indicated in the notice.

Sidmouth Urban District Council.—The Council have given notice of their intention to apply for authority to purchase the undertaking of the Sidmouth Gas and Electricity Company, under the terms of the Act recently passed, and supply gas and electricity in the urban district of Sidmouth and the parishes of Salcombe Regis and Sidbury, in the county of Devon. An extension of the time specified for the construction of electricity works will be applied for, as well as authority to raise the money necessary to complete the purchase.

South Suburban Gas.—The important amalgamation scheme for which this Company will seek parliamentary sanction next session was noticed last week (p. 543).

Staffordshire Potteries Water.—The Staffordshire Potteries Water Company will apply for the confirmation of their existing works and for power to construct new ones, comprising two pumping-stations, a service reservoir, and six aqueducts or pipe-lines; also for authority to pump and collect water on certain specified lands, and make provisions and regulations in regard to its supply. Further capital and borrowing powers will be required.

Sutton and Mablethorpe Water.—Authority will be sought for the incorporation of the Company, with power to supply water within the urban district of Mablethorpe and the parish of Sutton-on-Sea and other parishes in the county of Lincoln. It is proposed to ask for the repeal of part of the North-East Lincolnshire Water Act, 1906; and also for sanction to the purchase of the undertaking of the East Coast Water Company.

Swanage Gas and Water.—Application will be made by the Swanage Gas and Water Company for power to construct new water-works, comprising a well and pumping-station, a service reservoir, three adits, and two aqueducts or pipe-lines. Confirmation will be sought for the existing works. It is proposed to alter and increase the water-rates. The gas provisions of the Bill will relate to testing and pressure, the formation of special purposes and reserve funds, the supply of fittings and apparatus, &c. Additional capital will be required.

Swansea Corporation.—In a Bill which will be promoted by the Swansea Corporation mainly to obtain authority for the construction of sewers and tramways, further powers will be sought with regard to the supply of water; and the Corporation will ask for an alteration of their Acts with respect to the amount of compensation water to be sent into the Blaenant Ddu Brook.

Tavistock Urban District Council.—The Council intend to apply for authority to purchase the water undertaking of the Duke of Bedford, and supply water within their district, and also in the parishes of Tavistock Hamlets and Whitchurch, in the county of Devon. Power will be asked to maintain and improve the existing works, and make provision for their protection, as well as that of the services of water. Permission will be sought to raise the necessary money.

Tendring Hundred Water and Gas.—It is the intention of the Tendring Hundred Water Company to apply for an extension of their limits of supply so as to include the parishes of Dedham, Wrabness, and Little Bentley, all in the county of Essex; also for the confirmation of the existing works, and for authority to construct new water-works, comprising a well and pumping-station, a water-tower or elevated service tank, and four aqueducts or pipe-lines. The Bill will contain provisions in relation to the terms, conditions, and pressure of supply of water and gas, and to the quality and testing of the latter. Power will be sought to form superannuation and pension funds, and also to raise more capital.

Wakefield Gas.—The Wakefield Gas Company intend to apply for an extension of their limits of supply, so as to include the parish of Crofton and some neighbouring townships. The price of gas within the existing and extended limits will be fixed and defined; and it is proposed to cancel an agreement now in force between the Company and the Crofton Parish Council, and incorporate in the Bill such of the provisions as may be thought fit. Parliament will be asked to repeal the powers of the Ossett Corporation to supply gas in part of the parish of Crigglestone, and amend their Act of 1900. Additional capital will be required. The other provisions in the Bill will deal with the quality, pressure, and testing of gas; the appointment of a Managing-Director; the granting of superannuation allowances and the formulation of profit-sharing schemes; the adoption of the sliding-scale; and other matters now generally included in Gas Bills.

Wandsworth, Wimbledon, and Epsom District Gas.—Authority will be sought for effecting an amalgamation of the Wandsworth and Putney, Mitcham and Wimbledon, and Epsom and Ewell Gas Companies, with powers of supply over the area of the three Companies. It is proposed to maintain and extend the works, lay down lines of pipes in the parishes of Cheam and Sutton to link-up the Wimbledon and Epsom Companies' mains, and also to put in additional mains. It will be provided in the Bill that the standard price to be charged for gas within the extended limits of supply shall be the same as the respective prices now authorized within the limits of the three Companies concerned, or as may be prescribed. Power will be sought to raise any unissued capital already authorized, and also to borrow money. Provision will be made for the definition, division, and allocation of capital; the limitation of profits; the payment of compensation to Directors, Auditors, and officers; the quality, pressure, and testing of gas; and the exercise by the Company of powers conferred upon the Wandsworth and Putney Company as to stopping up certain roads, &c.

Windermere District Gas and Water.—The Windermere District Gas and Water Company intend to apply for power to construct additional water-works, comprising an impounding reservoir formed by means of an embankment across Dubbs Beck, a dam or embankment in extension of it for enlarging an existing reservoir, three conduits, and some road constructions and diversions. Authority will be sought to hold lands and impound and use water; also to raise more capital.

Woking District Gas.—Application will be made by the Woking District Gas Company to be dissolved and re-incorporated. The existing works are to be maintained and extended and new ones constructed. The area of supply includes the parishes of Woking, Send and Ripley, Pyrford, Byfleet, Wisley, Ockham, West and East Horsley, Chobham, Pirbright, and Bisley. The Bill will contain provisions in regard to the pressure and quality of gas, the means for testing it, the price to be charged, the terms and conditions of supply to persons having a separate service of gas or electricity, and to relieve the Company from obligations to supply such persons and premises. The repeal of the gas powers of the Woking Water and Gas Company and of the Ascot District Gas and Electricity Company will be applied for; also of four Woking District Gas Orders. The capital and borrowing powers of the Company are to be defined and regulated; and authority will be sought to raise more money.

York Gas.—The York United Gas Company will apply for power to extend their works and limits of supply. The proposed new area will comprise a number of townships and parishes lying within a distance of seven miles from the centre of Ouse Bridge, in the city of York. The Bill will provide (*inter alia*) for the alteration of the provisions of the Company's Special Acts with reference to the quality, pressure, and testing of gas, and the reduction of the illuminating power; the adoption of the sliding-scale; the holding of annual instead of half-yearly meetings; the reduction of the number of Directors; the granting of pensions and gratuities to officers and servants; and the erection and maintenance of dwellings for the employees. It is proposed to change the name of the Company. Additional capital and borrowing powers will be required, as well as authority to create special purposes and reserve funds.

Ystradfellte Water.—The Neath Rural Council will apply for an extension of the time specified in the Ystradfellte Water Act, 1902, for the construction and completion of the works authorized by that Act. The Bill to be promoted will contain provisions for securing the purity of the water and for taking water during the construction of the works. More money will be required.

PROVISIONAL ORDER APPLICATIONS (SESSION 1912).

Board of Trade, under the Gas and Water Works Facilities Act, 1870.

Cambridge Gas.—The Cambridge Gas Company will apply for an extension of their limits of supply so as to include the parishes of Great and Little Shelford, Stapleford, Impington, and Fulbourn, all in the rural district of Chesterton, in the county of Cambridge. The Order will contain provisions in regard to the Company's co-partnership scheme, and the disposal of moneys and securities held thereunder by nominations and otherwise, and regulations with reference thereto.

Chiddingfold and District Water.—The Chiddingfold and District Water Company will apply for power to continue and maintain their existing works; construct others, consisting of a reservoir and two pipe-lines; and supply water in the parishes of Chiddingfold, Dunsfold, and Witley, in the rural district of Hambledon, in the county of Surrey. Additional capital will be required.

Cleethorpes Gas.—Application will be made by the Cleethorpes Gas Company for an extension of their limits of supply so as to include the parish of Humberstone and parts of the parishes of Scartho and Waltham, all in the rural district of Grimsby, in the county of Lincoln, and for authority to exercise their existing powers in the extended limits. The Order will contain provisions in regard to the testing of gas and its supply in bulk. Additional capital will be required.

Conisbrough Gas.—Application will be made by the Conisbrough Gas Company, Limited, for authority to raise more capital, to alter the prescribed apparatus and burner for testing the illuminating power of their gas, and make further provisions in regard to its quality and the pressure at which it is supplied. In the event of the Company adopting a standard price with a sliding-scale, they will ask for authority to form and apply reserve and special purposes funds, and for the repeal or amendment of the provisions contained in the second schedule of their Order of 1903.

East Surrey Water.—The East Surrey Water Company wish to extend their limits of supply so as to include portions of the parishes of Chelsham and Woldingham, in the rural district of Godstone, in the county of Surrey; and they purpose applying for the necessary authority to do so, as well as to raise additional capital. They will ask for the confirmation of works of distribution constructed within the additional limits.

Elham Valley Gas.—Application is to be made by Messrs. J. F. Kelley and C. B. Tully for authority to construct works and supply gas within the parishes of Elham, Lyminge, Postling, and Stanford, in Kent, and to raise capital for the purpose.

Elham Valley Water.—The Elham Valley Water Company, Limited, will apply for authority to raise more capital.

Hatfield (Yorks) Gas.—The Hatfield Gas Company, Limited, will apply for authority to maintain and continue their existing works, construct others, and manufacture and store gas and convert residual products; also to "manufacture, produce, obtain, and supply the means of obtaining artificial light of any kind, and to acquire, hold, and use patent rights and licences for those purposes." The Company wish to be empowered to adopt a sliding-scale of price and dividend and provide reserve and insurance funds; and they will ask for more capital.

Henley-on-Thames Water.—Authority will be sought by the Henley-on-Thames Water Company, Limited, to extend their limits of supply so as to include further portions of the parishes of Rotherfield Greys, Rotherfield Peppard, Harpsden, and Shiplake, in the rural district of Henley, in the county of Oxford. It is proposed to construct a service reservoir and a rising main. Additional capital and borrowing powers will be required, as well as confirmation of the existing works.

Knottingley Gas.—The Knottingley Gas Company will apply for power to raise additional capital, and to capitalize money which has been expended out of revenue upon the extension and improvement of their works, and distribute it among the shareholders. The Order will contain provisions in regard to the price, quality, and testing of gas, its supply in bulk, and the erection of dwelling-houses for the employees.

Seascale Gas.—Application will be made by the Seascale Gas Company, Limited, for authority to maintain and continue their existing works and construct others; also to manufacture and supply gas engines and fittings. The Company's limits comprise the parishes of Seascale, Gosforth, Drigg, Carleton, and Holmrook; and they wish to be empowered to supply gas within them, and in bulk to local authorities and others, both within and beyond their area. Additional capital will be required.

Swansea Gas.—Application will be made by the Swansea Gas Company for authority to manufacture and store gas and residual products on a piece of land in the parish of Llansamlet, in the county borough of Swansea, and to use their existing funds for the purposes of the proposed Order.

Thurles Gas.—The Thurles Gas Company, Limited, will apply for power to maintain and continue their works, manufacture and supply gas "in and about" the town of Thurles, in the county of Tipperary, and raise additional capital.

Welwyn, Knebworth, and District Gas.—Application will be made by the Welwyn, Knebworth, and District Gas Company for authority to maintain the existing works and construct others for the manufacture and storage of gas and residual products, and supply gas in a number of parishes in the county of Hertford. The Order will contain provisions as to the price, quality, and testing of gas, and the capital and borrowing powers, and conferring upon the Company power to deal in coal, coke, residuals, meters, stoves, &c.

West Kent Gas.—As mentioned in the "JOURNAL" last week (p. 543), the West Kent Gas Company will apply for authority to manufacture and store gas and residual products on land adjacent to the River Thames at Erith, and to apply their funds for the purpose.

Wimborne Minster Water.—The Wimborne Minster Water Company, Limited, will apply for an Order to sanction the maintenance, alteration, and extension of the existing works and reservoirs, the construction of additional works, and the extension of the limits of supply. They will ask for additional capital and borrowing powers, as well as authority to supply meters and fittings, and require consumers to provide cisterns. Relief will be sought from the obligation to afford a constant supply of water.

Local Government Board, under the Public Health Act, 1875, and the Gas and Water Works Facilities Act, 1870.

Bala Gas.—Authority will be sought by the Bala Urban District Council to purchase the undertaking of the Bala Gas Company, Limited, and to manufacture and supply gas within the urban district; also to levy rates and charges, supply fittings, and make agreements for furnishing a supply beyond the limits. Further borrowing powers will be required.

Coalville Urban District Gas.—Authority will be sought by the Coalville Urban District Council to utilize certain lands belonging to them for the general purposes of their gas undertaking, and to construct and maintain works thereon. It is intended to ask for the amendment of the provisions of the Council's Act of 1899 relating to the quality, pressure, and testing of gas, and to make others in regard thereto, as well as generally with respect to the supply and consumption of gas and the payment and recovery of gas and meter rents and charges. Additional borrowing powers are required.

Dawlish Urban District Council.—The Dawlish Urban District Council will apply for authority for the compulsory purchase of certain lands in the parishes of Ashcombe, Chudleigh, Kenton, and Mamhead, in the county of Devon, for the purposes of their water undertaking, and to enable them to protect their sources of water supply from contamination.

Harrington Urban District Gas.—Application will be made by the Harrington Urban District Council for authority to acquire the undertaking of the Harrington Gas Company, Limited, maintain and carry on the works, and supply gas within their district. The Order will contain provisions in regard to the quality and testing of gas.

Hipperholme Urban District Council.—The Council have given notice of their intention to apply for authority to construct, maintain, and continue a gas supply for public and private purposes within the part of their district which is not now supplied by any company or person authorized by Parliament, and to borrow the necessary money.

Secretary for Scotland, under the Private Legislation Procedure (Scotland) Act, 1899.

Arbroath Gas.—The Corporation of Arbroath intend to apply for power to borrow more money for the extension, maintenance, and improvement of their works, and for the general purposes of their gas undertaking. They wish to alter and reduce the illuminating power of the gas, and prescribe and fix such power as they think fit, or as may be specified in the Order; also to provide for the testing of the gas at the minimum standard which may be prescribed, and at such places as may be named in the Order, and make further provisions with respect to the testing of gas and meters, and the allowances or surcharges to be made in respect of meters registering incorrectly. The Corporation will ask to be exempt from any penalty for insufficiency of pressure, defect of illuminating power, or excess of impurity in the gas, when such insufficiency, defect, or excess is due to circumstances beyond their control. Authority will be sought to charge differential rates, allow discounts, and alter existing rents, rates, assessments, and charges.

Dunbar Water.—The Corporation of the Royal Burgh of Dunbar will apply for authority to provide an additional water supply for the burgh and the districts and places adjacent. It is proposed to construct a reservoir, an embankment, and a conduit or pipe-line, and make two access roads. The Corporation will ask for the legalization of the existing works, and for an extension of the limits of supply. Borrowing powers will be required.

Glasgow Boundaries.—The Corporation of Glasgow have given notice of their intention to apply for a considerable extension of their boundaries, and for authority to enter into agreements with any company or person supplying gas, water, or electrical energy in the added area, and make special rates for such supply.

Glasgow Corporation.—Authority will be sought by the Corporation of Glasgow to construct additional water-works, consisting of three aqueducts, one commencing at the Craigmaddie reservoir, and two continuing from it to Glasgow. It is proposed to ask for further powers in regard to the reinstatement and maintenance of cisterns and other apparatus for the reception, storage, and supply of water, in cases where they have been, or may be, removed or discontinued; and for authority to require the provision of separate service-pipes for the supply of pumped water. It is proposed to extend the Corporation's area of gas supply in the parish of Mearns; the added area to form part of the supplementary supply district, and also part of the Corporation's gas undertaking. The portion of the Busby and District Gas Order of the present year relating to the added area is to be repealed. Further borrowing powers are required.

Glasgow Water (Charges).—The Glasgow Corporation will apply for authority to alter the charges for water supplied for domestic purposes beyond the compulsory limits, so that they shall not exceed the amount of the domestic water-rate within those limits. It is proposed to ask for the amendment or repeal of the Corporation's Water Acts passed from 1855 to 1909 in this respect.

Prestonpans Combination Water Trust (Finance).—Application will be made by the authorities constituting the above-named Trust for an extension of time for the repayment of loans sanctioned for providing a water supply for the district of Prestonpans and Tranent (Landward), and the burghs of Prestonpans and Cockenzie and Port Seton; also for power to borrow money for the repayment of the existing loans.

Plymouth Corporation Water-Works.—Mr. F. Howarth, the Water Engineer of the Plymouth Corporation, presented his annual report to the Water Committee last week. It showed that the income for the year ended the 31st of March last was £34,041—an increase of £668 on the previous year. The cost of upkeep and management was £10,590, or £647 more than in 1909-10; and the gross profit was £23,450, or £21 more. Interest, sinking fund charges, and income-tax absorbed £16,443, which was a reduction of £1068; leaving a net profit in aid of the rates of £7007—an increase of £1089. The capital expenditure, on extensions and renewals of mains, was £1045. At March 31 last, the total capital outlay was £382,822; and, including expenses of stock issues and capital in hand, the total amount borrowed was £398,530. Of this sum, £127,793 had been repaid or was in the redemption fund. The estimated number of supplies at the close of the financial year was 21,106. The quantity of water which left the storage reservoir was 6,266,000 gallons per day, equal to 44·34 gallons per head, of which the rate for domestic consumption was estimated at 32·24 gallons.

LEGAL INTELLIGENCE.

POLLUTION OF A STREAM AND DESTRUCTION OF FISH.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Thursday, Nov. 23.

(*Before Mr. Justice* NEVILLE.)

Foster v. Charing and District Gas Company, Limited.

This was an action to recover damages for the pollution of a stream and destruction of the fish.

Mr. JENKINS, K.C., and Mr. HILDESHEIMER (instructed by Messrs. Oliver Richards and Parker) appeared for the plaintiff; and Mr. PETERSON, K.C., and Mr. MANNING (instructed by Messrs. Paterson, Candler, and Sykes, agents for Messrs. Ellis and Ellis, of Maidstone) represented the defendants.

Mr. JENKINS, in opening the case, said the plaintiff, Captain Foster, sought to recover damages from the defendants for a common law nuisance and for the destruction of his fishery, by causing water impregnated with ammonia to flow into the stream. He also claimed penalties under section 68 of the Public Health Act, 1875, of £20 per day during the continuance of the nuisance after notice. The evidence would be conclusive that the fishery was practically ruined, and every trout in the stream killed, by certain foul water which ran into it; and the only issue would be whether the water emanated from the defendants' works, which they denied. Captain Foster was the lessee of a fishery in the River Stour, near Ashford, under two leases—one from Sir Henry Dering, and the other from Lord Hothfield—for three years from Feb. 1, 1910—the rent payable being £40 in the one case and £35 in the other; and there were covenants to fish in a sportsmanlike manner, &c., and to keep and leave a fair stock of trout in the river. The length of river granted was about 2½ miles, and extended from a place called "Little Chart" to a bridge the distance named lower down. The fishing season ended on the 1st of October, and down to this time plaintiff and his friends fished the stream with success; but on the 11th of the month, Mr. Ellison, the Rector of Hothfield, on hearing something from Albert Lockwood, under-keeper to Sir Henry Dering, went with him to the river and found the water discoloured, and a large number of dead fish in it. They walked up the river as far as the junction with the Charing Brook, above which there was no discoloration. On the gas-works there was the tank of a disused holder (the holder having been removed), and his case was that the water in the tank was pumped out, and allowed to run into a drain which carried it to the sewage-works, through which it flowed with the sewage, after treatment, into the Charing Brook, and thus into the River Stour, so causing the damage complained of. The sewage works were of the ordinary description, and would not, as he was instructed, remove the ammonia from the gas water passing through them. Having cited a very similar case of *High Wycombe Corporation v. Conservators of the River Thames*,* in which, on appeal, the Corporation succeeded in escaping penalties, but Mr. Justice Grantham and Mr. Justice Kennedy said the Gas Company had been very properly fined, the following evidence was called.

Rev. *H. R. Neville Ellison*, Rector of Hothfield for the last seven years, said he knew the fishery in question, and was accustomed to fish there. In 1910 it was a good season, and up to the events complained of there had been no trouble. [Witness identified the *locus in quo* on a map.] On the 11th of October, Lockwood made a communication, and he went with him up the Stour. They saw in the stream dead and dying fish, mostly trout, with a few coarse fish; and eels were coming down on the surface looking very sick. There was a bluish tinge on the water, and also on the mud where the water had left it. They pulled out about 70 dead trout. The discoloration was more perceptible as they approached the junction of the river with the Charing Brook. Above the junction there was no discoloration, nor were there any dead fish. Half-a-mile above the junction there were paper-mills; but there was no sign of any pollution. They then walked up the Charing Brook, and where the outfall from the sewage-works entered the brook, there was a very strong gassy smell. He went to the Charing Gas-Works and saw the tank of an old gasholder in which there was a lot of water, and there was a pump connected with it. The water smelt very strongly. The caretaker told him he had orders to pump out the old tank.

Mr. PETERSON said he would admit that the tank was being pumped out from the 3rd to the 11th of October.

Examination continued: He wired to Captain Foster; and on the following day they went together to the stream, and with a landing net took out about 120 dead trout, 14 pike, and a number of coarse fish. A few days after, at the request of Mr. Ball, the defendants' Manager, he sent a dead trout to Mr. Cribb for analysis. The plaintiff had since done some re-stocking—in the early part of this year; but he (witness) had never seen any live trout in the stream.

Cross-examined: He was not on the stream the week previous to Oct. 11, and could not speak to its condition then.

Captain *A. Foster*, the plaintiff, gave evidence to the same effect. He said there were plenty of fish in the first year of his tenancy; but since Oct. 12 he had seen no live fish until he re-stocked the river at an expense of £135. He put in 200 12-inch, and 300 8-inch fish, and Sir H. Dering and Lord Hothfield also put in some; but the river was not yet properly stocked. He had not caught any this year, and was uncertain about next year.

Cross-examined: Some of the dead fish rose to the surface, but not all. He picked out some from the weeds, where he could see them. He did not notice the bluish discoloration of the water or banks spoken to by the previous witness. He did not know of any sheep-dips near the Stour; but there might be some. He wrote to the "Field" on Oct. 13 saying that all the fish in the river had been killed between

* See "JOURNAL," Vol. LXXI., p. 81.

Little Chart and Ripper's Cross, a distance of about four miles. This included more than his lease covered.

Albert J. Lockwood, under-keeper to Sir H. Dering, spoke to seeing a bluish-looking scum on the Charing Brook at about 8 a.m. on Oct. 11, and about 11 a.m. he was by the Stour and saw a trout jump out on to the bank, where it died He walked up the stream some 200 yards, and saw 15 or 20 more dead trout. He told Mr. Ellison what he had seen, and the same afternoon accompanied him up the stream as described by that witness. The water was still discoloured, but not so much as in the morning.

Cross-examined: From October, 1910, until the river was re-stocked in February, he did not see any fish in it, either below or above the junction. There was at the paper-mills a large pond which was sometimes emptied into the river, then it stirred up the mud, and raised the level of the stream. He did not notice anything unusual in the river the week before Oct. 11. He knew there was a sheep-dip near the river, between the junction of the brook and the paper-mills; and there was a place close by where they treated sheep for foot-rot.

Re-examined: He believed sheep were dipped in the summer, not in October.

Mr. *Alfred Sims*, of Charing, Surveyor to the West Ashford Rural District Council, and Sanitary Inspector, spoke to going to the gas-works about some tar on the 7th or 10th of October (he was not sure which), when he noticed a pump connected with the tank of the disused gasholder; and Marshall, the man in charge, said they were getting rid of the gas water. Witness asked him if it was going to do any harm; and he said he thought not, as where he came from people were rather glad to have such stuff to put on the land. He made a few strokes with the pump, and turned out a few gallons of water which ran into a drain connected with the sewer. It gave off a strong smell of ammonia. On the 12th of October, when in the sewage-works, which he frequently visited, he detected a strong odour of ammonia in the valve-chamber.

Cross-examined: The daily outflow of sewage through the works was practically about 24,000 gallons; and before it joined the stream it was mixed with about an equal quantity of spring water. There was a certain amount of ammonia, and also of sulphuretted hydrogen, in sewage; but the smell of ammonia was not usually perceptible. The effluent, as a general rule, was practically colourless. It had never been analyzed, so far as he knew.

Re-examined: When he visited the gas-works, the level of the water in the tank had been lowered about 2 feet. He did not detect the smell of ammonia until the pump was worked. He did not remember any previous occasion on which fish in the river had been killed.

John Kemsit, a waggoner, who lived very near the outfall from the sewage-works into the Charing Brook, spoke to an odour of gas coming from the brook in October, 1910, on two successive days, but worst on the first day. He noticed that the water running out of the pipe into the brook was black, and smelt very strongly. He had never noticed it before. There was a sheep-dip opposite his house. Dipping was generally done in July and August—never as late as October. The water used for dipping was taken away in barrels.

Cross-examined: Sometimes the water stopped for a few months before it was taken away. The dip was filled from the brook, and had an overflow into the brook. The black outflow he noticed was bigger than usual. He did not notice whether it was thick.

Other witnesses spoke to detecting a strong smell of gas tar on the river, noticing a blue colour on the surface, and seeing a number of dead fish.

Mr. *H. Grierson*, the manager of the fishery at Harrietsham, said he visited the River Stour, at Captain Foster's request, on the 3rd of February last. He could not see one trout; and the insects on which trout fed were also conspicuous by their absence. To properly re-stock the stream would require something like 1500 young fish of different sizes, costing about £136. It was on his advice that Captain Foster introduced the quantity he had spoken of. The Stour was reckoned a good trout stream.

Dr. *J. E. Gardiner*, Lecturer on Toxicology and Physiological Chemistry, said he was acquainted with the operations of a gas-works. The water in a gasholder tank would become impregnated with ammonia, which was the most powerful poison for fish; and if gas water in any quantity were turned into a stream, it would kill them. Lime and tar were also injurious to fish. In his opinion, such gas water as had been described would pass through sewage-works without losing its ammonia. Fish killed by ammonia would not show any traces of it in the stomach or intestines. His opinion was that the fish in the present case died from a deficiency of air in the water for the purpose of respiration.

Friday, Nov. 24.

On the resumption of the case this morning,

Dr. *Gardiner* gave further evidence. He submitted the result of experiments he had made to ascertain the percentage of ammonia present in water which was fatal to fish. He said he found that with 1·48 parts of ammonia in 100,000, a gudgeon died in an hour; with 1·7 parts to 1000, it died instantaneously. He also gave the result of experiments with ammonium salts, lime, tar, carbolic acid, and certain reducing agents, which would abstract oxygen. A sample of 20 parts of ammonia in 100,000 parts of water gave a barely perceptible odour. To be appreciable at any distance, it must be at least a deci-normal solution.

Cross-examined: For the odour to be detected at any distance, the solution must be very strong indeed. An ordinary sewage effluent, if run into a stream in large quantity, would be harmful to fish, but would not kill them. He could not say whether trout living in a stream which contained 0·2 part of ammonia per 100,000 parts would suffer; he did not think they would die, supposing this condition continued for 48 hours. Gas after purification would always contain traces of ammonia when passed into the holder, and would impregnate the water in the tank; but he could not say to what extent. If the gas-holder had been out of use for eleven years, he could not say whether the ammonia in the water would escape. If it were a strong solution, a good deal would probably escape. It was a volatile gas, very soluble in water. If tar were poured into water, part would sink and part float. If it were present in sewage, part would probably pass through the works, and part might be removed. Ammonia was colourless, and when put into pure water would not change its colour; but if a stream contained substances on which ammonia could act, a change of colour might result.

By his LORDSHIP: The ammonia dissolved in the tank water would, in his opinion, remain practically free for a long time.

James Strover, a labourer who worked in Sir H. Dering's gravel pits, said he remembered on two occasions in October, 1910, noticing that the water in the brook was "diluted;" it looked something like milk and water. He saw another man take three dead eels out of the stream. He also saw a number of fresh-water shrimps floating down, but did not examine whether or not they were dead. He had never seen this before or since.

This concluded the plaintiff's case.

Mr. *F. L. Ball*, a Director of the defendant Company, and Manager of the Mid Kent Gas and Water Companies, said he purchased the Charing Gas-Works, in conjunction with Colonel Thompson, eleven or twelve years ago; and the concern was carried on for some years as a private undertaking. The present Company was incorporated in 1905. When he purchased the works, there were two gasholders—one large and the other quite small. The latter was then out of use; the sheeting at the top being defective, and no longer gas-tight. It had never been used since until recently. All the rain which fell on the holder ran into the tank, either through the holes in the top, or round the sides. Witness put in a plan, and explained the method of gas manufacture and purification. He said the latter was done with oxide of iron. The tar and ammoniacal liquor were collected in the tar-well and sold. There were no means by which the ammoniacal liquor could get into the drains or the gasholder tank, which had a capacity of 23,000 gallons. Last year they decided to have the small holder repaired; and to do this it was necessary to empty the tank, for which he gave instructions to Mr. Marshall, the manager of the works. On Oct. 14, 1910, he received a letter from Mr. Brown, the agent to Lord Hothfield, which he answered the same day, and immediately made inquiries at the works. He found about 2 feet of the liquor had been pumped out of the tank—representing 4500 gallons. On Oct. 17, he met Mr. Brown at Hothfield, and went to see Mr. Ellison, when he heard about the dead fish. He walked with Mr. Brown some distance down the stream, as far as Ripper's Cross. On the 25th he visited the paper-mills at Little Chart, and on the bank saw a large heap of spent chloride of lime, which was only kept from falling into the river by a plank on edge; and there were distinct traces of some of it having dropped into the stream. On the 19th, in company with Mr. Marshall, he found a dead pike in the stream, and sent it to Mr. Cribb for analysis. In walking by the Stour, he noticed several sheep-dips, one of which was full of liquid; and in the place used for treating sheep for foot-rot was a solution of sulphate of copper. He visited the sewage-works, and agreed with the evidence given by Mr. Sims as to the quantity of effluent and the proportion of spring water which mixed with it. The water in the Charing Brook at the sewage outfall was running at from 5000 to 6000 gallons per hour; and it increased in volume as it approached the Stour, where it was from 20,000 to 30,000 gallons per hour. Just below the junction, he found the volume of water in the river to be about 975,000 gallons per hour. This was on the 19th of October. On Oct. 26 this year, when the water was much lower, it was 376,500 gallons. On Nov. 18, it was 1,128,000 gallons. On Nov. 4 this year, the volume in the small brook was 33,720 gallons per hour; on the 18th, it was 186,750 gallons. At the sheep-dip near Dog Kennel Farm, there were evidences of its having overflowed into the river. On Oct. 25 last, being in London, he had brought to him three dead fish which had been taken from the Stour that day; and the next day he went along the river and saw on the banks and in the stream nine dead fish. On the same day he visited the sewage-works, and saw there large quantities of dead worms. Nothing whatever was sent into the sewage from the gas-works at that time. The small holder was re-sheeted and brought into use in September. Of the water left in the tank after the complaint in October, 1910, some was put into barrels and sent away; and when it was found to be innocuous, the rest was pumped into a sump dug in their own grounds. A sample of it had been analyzed. It would take from 40,000 to 50,000 gallons of additional water to raise the Stour 2 inches. When he went to look at the tank after hearing from Mr. Brown, there was no smell arising from it.

Cross-examined: The tank was of brick, and rose just above the surface of the ground. He and Colonel Thompson bought the works from the old Charing Gas Company, who had no statutory powers, which the present Company had. The old holder appeared to have been out of use for two or three years. He never heard of any trouble arising from an overflow of the tank while it was out of use, notwithstanding that the rain was continually falling into it. He had no doubt the water leaked away into the soil through the old brickwork. The average rainfall was less than 0·1 inch per day. Since he had known the works, the ammoniacal liquor and the tar had always been sold. He could not fix the exact date when they decided to re-sheet the old gasholder; but it was probably in July or August. The pump used to empty the tank was borrowed for the purpose. It was used for a few minutes each day on Oct. 3, 4, 5, 6, 7, and 10, as Marshall informed him, and he thought on the 17th. He ordered the pumping to be stopped on the complaint being made. About 3200 gallons were sent away in barrels in December. On Oct. 14, he received a sample (2 quarts) of the tank water, and took it to Mr. Cribb for analysis on the 20th. The paper-mills were on the right bank going up the river. Chloride of lime was employed for bleaching. After being used, he did not know that it was of any value. There were traces of it down the bank. Near the river there were three sheep-dips, each of which was full of liquid when he saw them. He heard that a dead dog and two cats were found in the tank when it was emptied; but he did not see them. There was no smell of ammonia with the sample of water sent for analysis.

Re-examined: The barrels of water were sent to Snodland and emptied on the ground—some of them in his presence; and there was no smell of ammonia.

Mr. *H. P. Maybury*, M.Inst.C.E., Kent County Surveyor, attending

on subpœna, said that from 1898 to 1903 he was working with the County Analyst of Worcester, on behalf of the Worcester County Council, on experiments with regard to the effect of sewage effluent on fish. His attention was called to this matter; the suggestion having been made that the tarring of the roads was the cause of the mischief. He was satisfied that it had nothing to do with it; and he believed most people agreed with him. He went to inspect the Stour and the sewage-works on Oct. 25, 1910; and there was no trace of sewage pollution. There was a little sewage fungus on the banks near the outfall, as was always the case. There was no trace of tar, or ammoniacal liquor. He took from the brook a sample of water, which he tested roughly, and no pollution was found beyond what always occurred in such waters. He had seen Mr. Cribb's analysis of the tank water, and should say that if the contents of the tank went through the sewage-works into the river, it would be impossible for it to destroy the fish.

Cross-examined: When he examined the river on the 25th of October he should have expected to find traces of ammonia or tar, if it had been passed in recently, unless there had been a heavy rainfall; but he should not call fifteen days recent. The quantity of organic solids in solution shown by the analysis—viz., 152 in 100,000—was certainly large, but not unusually so for stagnant water of such a character. He did not say that fish would live in the water; but when diluted as it was in this case, it would not do harm. As the County Engineer, he had often seen the old gasholder, and knew its rusty and corroded condition, which would account for the large quantity of solids found in the water.

Mr. *G. K. Benton*, agent to Sir H. Dering, attending on subpœna, said he had known the stream in question all his life. About 1904, he remembered some 15 or 20 dead fish being found in the Stour below the junction of the Charing Brook. Last February, 300 young trout were put into the river, half the cost of which (£7 15s.) was borne by Sir H. Dering—the other half by Lord Hothfield.

Mr. *William Marshall* said he went to the Charing Gas-Works as working manager in August, 1910, and had remained there ever since. The small gasholder was out of use, being very dilapidated. Shortly after he went, he sent some ammoniacal liquor in barrels to the Mid Kent Gas-Works at Snodland. On the 3rd of October, he started pumping the water out of the tank, and pumped for about an hour in the evening, while he was waiting for the heat to get up in the furnaces. He did the same each day that week up to Friday, and again the next Monday. He did not detect any smell from the water; and it had no colour beyond that of ordinary dirty water. When Mr. Ellison came to the works on the Tuesday, there was no pumping going on. On the previous Saturday, he had cleared out one of the oxide purifiers; and on the Tuesday, he had been turning the stuff over, and it smelt very strong. When Mr. Sims called, he (witness) showed him how the pump worked; it was a diaphragm pump. The smell to which Mr. Sims referred probably came from witness's clothes, as he had been in the purifier. When a police sergeant and a constable came to the works and talked about the water in the tank having killed the fish, he drew up a bucketful and drank half-a-pint; and he felt as well after it as he did at that moment. Witness described the taking of the sample in the presence of Mr. Champion, who took it away. This was done on Oct. 14, 1910. On Oct. 25 he went with Mr. Ball and Mr. Champion to the paper-mills, where he saw a heap of whitish stuff—chloride of lime—on the bank. It was close to the edge, and there were signs that some of it had been washed down. In October of the present year, he went with Mr. Ball and Mr. Cribb to the sewage-works, and saw a number of dead worms in the gullies. On a subsequent visit, with Mr. Ball, the gullies were full of dead worms. On another day he went by himself down the brook to the Stour, and along it some way. He took out three dead fish, and saw a dozen or more in the river. He took the three fish to the works, and gave them to Mr. Champion. On a subsequent day, he saw several more dead fish. After the 10th of October, he had never pumped water from the tank into the drain.

Cross-examined: He did the whole of the work at the gas-works. He knew that it was decided to repair the small holder, and that the tank would have to be emptied; and he started to do this when opportunity offered. There were not more than 2 feet of water pumped out when Mr. Ellison called. Witness was cross-examined at some length on notes he had made at the time in a memorandum-book which he thought he had destroyed, and in another book he had with him, as to the dates and incidents. He said he dug the pit and poured the rest of the tank water into it on his own responsibility, without any orders from Mr. Ball, as far as he remembered. When he found the dead fish this year, he did not notice any particular discoloration of the water, or any smell. There were two dogs and about four cats in the bottom of the tank. One dog had the hair on; all the other animals were rotten.

Mr. *John Champion*, outdoor superintendent of the Mid Kent Water Company, said he visited the gas-works at Charing on Oct. 14, 1910, and saw Mr. Ball, who told him about the dead fish. He went with him, Marshall, and Stroud along the river. At the paper-mills he took from a heap by the side of the river a sample of spent chloride of lime, which he gave to Mr. Ball. It had a strong smell. He was present when Mr. Marshall drew a sample of the water from the tank, and witness took it home and gave it to Mr. Ball the same night or next morning. There was no smell of ammonia about it. That was on Oct. 14 according to a note in his diary. On Oct. 25 of this year, in consequence of a telephone message, he went to Charing, and received from Mr. Marshall three dead fish, which he took to Mr. Ball, and they were sent to Mr. Cribb. Next day he went again to Charing, and visiting the sewage-works they saw thousands of dead worms in the gullies. They afterwards went down to the river, and found several dead fish in the weeds.

Monday, Nov. 27.

The hearing of the case closed to-day. His Lordship gave judgment for the plaintiff with costs, granted an injunction, and directed an inquiry as to damages, the costs of which would await the result. A report of the concluding proceedings will appear next week.

LIABILITY FOR STREET ACCIDENTS.

Dangers of Stopcock Boxes.

At the Greenwich County Court a few days ago, before his Honour Judge Colpitts Granger, William John Poole, of 14, Arngask Road, Catford, brought an action against the Metropolitan Water Board and Mr. William Edward Howell, of Eglinton House, Eglinton Road, Ramsgate, to recover £10 damages for personal injuries through alleged negligence. Mr. Ganzoni appeared for plaintiff; Mr. Goodling represented the Water Board; and Mr. Friedmann attended on behalf of Mr. Howell. Plaintiff said that shortly after twelve o'clock on the morning of Aug. 22 he was walking along the pavement in Laleham Road, Catford, when he caught his right foot in a stopcock box outside No. 55, of which Mr. Howell was the landlord. He was thrown forward, and injured his knee; and as a result, he was laid up a fortnight. The corner of the box lid had been broken off; and on the following day the occupier of the house wrote the word "Danger" on the pavement. Mr. Howell said he knew nothing as to the cause of the accident. Mrs. Coe, residing at the house in question, stated that she saw four men with lanterns and long sticks 'groping about on the pavement. They had just come away from the stopcock box outside the house. It was all right when she went to post a letter at five minutes to twelve; but upon her return the top of the box was projecting. Mr. Goodling said the Water Board denied liability; and he called Henry Middleton, an employee of that authority, who stated that he found the box broken between two and half-past on the morning of the 22nd of August. An examination would not have taken place before that time. His Honour held that there was no evidence that the Board's employees broke the box; and he dismissed that authority from the action. He ordered Mr. Howell to pay plaintiff £10, with costs, and also the costs of the Water Board.

Interference with Newly-Repaired Roads by Children.

During the hearing by his Honour Judge Woodfall, at the Westminster County Court, of a case in which the Metropolitan Water Board were alleged to be responsible for a trap accident in Carlsbad Street, King's Cross, owing to a hole made in the roadway in connection with repairs, a witness for the Board stated that the hole was properly filled up and repaired, but that the stones and earth were immediately displaced by children in the neighbourhood. Another witness said a great amount of trouble arose with children in connection with the repairing of the roads. He had taken from them articles ranging from a child's spade and shovel up to a wheelbarrow. He had also seized boxes that were filled with stones, and for his pains had been grossly insulted by the parents. So persistent were children in obtaining stones for the building of "grottos," that he had seen a newly filled-in hole in a roadway that had been gone over by a steam-roller almost immediately dug up again by children. His Honour said there were some doubts in the case, and, of course, the Water Board felt that it was a matter of importance to them, seeing that they were exposed to the depredations of children such as had been explained in evidence. But though there was a good deal of suspicion in connection with the case, it had been given as a fact that the ground had been excavated; and a constable in his evidence had used the word "subsidence." The case must rest on this; and there would be judgment for the plaintiff for £12 damages and costs.

Belfast Gas-Works Injunction Case Dismissed.

Last Thursday, in the Chancery Division in Dublin, before Mr. Justice Ross, a case was mentioned for settlement, in which Mr. D. G. Meharg, of Ulster House, Ormeau Road, was the plaintiff, and the Corporation of Belfast the defendants. Plaintiff claimed an injunction to restrain the Corporation from creating a nuisance at his public-house and billiard-rooms, by causing dust, smoke, steam, and offensive smells to be emitted from the gas-works, by reason of which he alleged his business premises and trade were injured. Plaintiff also claimed an account for damages. The defendants denied there was any nuisance arising from the gas-works. They also denied that plaintiff suffered any injury, and averred that they had been carrying on their works with due care and skill, and without negligence. Mr. Thomas Harrison (with whom were Mr. Stephen Ronan, K.C., and Mr. Gordon, K.C., M.P.), for the defendants, said he was glad to inform his Lordship that he would not be troubled with the hearing of the case. The writ had been issued more than two years ago; and the plaintiff had allowed the action to drag on, compelling the Corporation to submit to legal expense. But at the last moment he had failed to "face the music." The defendants were prepared to show that there was no gas-works in the kingdom better organized, better equipped, and having more thoroughly up-to-date appointments; but this became unnecessary now. The plaintiff evidently expected that the Corporation would at some time or other pay him damages rather than incur the cost of contesting the case. The Corporation were determined to stop once and for all claims such as that of the plaintiff; but, not being vindictive, they had consented to the action being dismissed without costs. His Lordship made an order dismissing the action without costs, in the terms asked for by defendants' Counsel.

East Hants Gas Company, Limited—Capital Reorganization.

On Tuesday last, Mr. Justice Parker, in the Chancery Division of the High Court of Justice, heard a petition presented by the Company asking the Court to confirm resolutions for reorganization of the capital under section 45 of the Act. Mr. Stamp said the Company was registered with a capital of £30,000, divided into 1500 8 per cent. preference shares and 1500 ordinary shares of £10 each. The object of the reorganization of capital was to reduce all the shares to one class—viz., ordinary shares—to enable extended powers to be applied for by Provisional Order or by Act of Parliament; there being a practice not to allow a statutory grant to companies paying a preferential dividend exceeding 5 per cent. Meetings of both classes of shareholders had been held, at which the resolution had been passed by the requisite majority. His Lordship made the order.

MISCELLANEOUS NEWS.

MR. CHARLES CARPENTER ON CO-PARTNERSHIP.

The Half-Yearly Meeting of the Labour Co-Partnership Association was held last Saturday in the New Masonic Buildings, High Street, Oxford. The previous evening, Mr. Charles Carpenter, the Chairman of the South Metropolitan Gas Company, opened a discussion on the subject of co-partnership before a gathering in Baliol College. In the general questions brought forward at these meetings, "JOURNAL" readers have no special concern; but the remarks made by Mr. Carpenter will doubtless interest them.

Mr. CARPENTER, after a few prefatory remarks, said: I do not think anyone can look back upon the events which have taken place in the labour world during the past few months without arriving at the conclusion that some grave defects must exist in our industrial system. Throughout the length and breadth of the land, there has been an upheaval of turbulence and discontent unprecedented in its character, and which certainly shook at its foundations the complex structure of our modern civilization. To what must this outburst be attributable? I think there can be no doubt that, whatever may have been its origin, the rapid extension of disaffection must be ascribed to the existence of a widespread belief among the working classes that they have not had their fair share of the increased wealth and prosperity the country as a whole has enjoyed. On every side are evident signs of the greater luxury existing to-day compared with (say) a quarter-of-a-century ago; and, in considering them, the average workman who asks whether his position and prospects in life have improved in the same degree, almost invariably answers in the negative. On the other hand, most employers, if questioned upon the subject, would just as unhesitatingly affirm that their men did not work so well as formerly, that they took less interest in their employment, and could be less depended upon to perform satisfactorily the duties required of them than in the past.

If in these two statements may be shortly summed up the men's and the masters' cases, I believe there is a large proportion of truth in both, and that they may fairly be considered to describe the state of affairs existing to-day by reason of which our industries are divided into two opposing camps—the employers and the employed.

My earnest belief is that there is a remedy; and I know of only one for this deplorable state of things. It is industrial co-partnership. In this connection, I cannot do better than quote the words uttered nearly forty years ago by the late George Jacob Holyoake:

> The workman has the great latent faculties of skill and goodwill, contriving, saving, and perfecting qualities, which are never enlisted by a service of inferiority where the one man is a mere instrument for promoting the ends of another, bound to fidelity only by the tenure of starvation—the workman designing to desert his employer, and the master intending to dismiss the man the moment either can do without the other.

And he goes on to say:

> Industrial partnership is a policy of buying the skill and the will of a man—his genius and his self-respect, which elevate industry into a pursuit of art, service into companionship refined by equality and rewarded by mutual, though different, degrees of competence.

Let us for a moment compare the difference between a student entering life from one of these Universities to follow (say) the profession of medicine. Fortune may smile upon him, and fortuitous circumstances not unassociated with ability may lead him to the Mecca of Harley Street. Another man, not less able nor less qualified, but less fortunate in his associations, may eke out a scanty existence by ministering to the bodily wants of the poorest of the poor in the slums and alleys of the East End of London. Between these extremes, lie many means; but my point is that every one of those students has a chance of success in the lottery of life. I have only taken medicine as an example, though what I have stated is true of other learned professions also.

But how does the workman stand under the wages system of payment for his labour? All over the country there are in vogue standard rates of remuneration, which custom (more or less by bargaining) has fixed as commensurate with surrounding conditions. But whether the workman's life chances associate him with an undertaking whose yearly profits may be reckoned in millions or one in which both ends scarcely meet, he still works for the standard rates of pay. No community of interests exists which may ameliorate his lot; and he still toils on with the same prospects and the same absence of hope for better things.

Now it is this state of things which I believe is at the bottom of much of the industrial unrest; and this is the evil which this Association urges the adoption of co-partnership to remove. The principle upon which it is based is that after capital has been fairly remunerated for the risks it takes by its investment in an undertaking, it should give to the employees a fair share of the further profits. How will this work out in practice? I cannot give you a better example than that of the Company of which I am Chairman—the one which supplies gas to London south of the Thames. The share capital of the undertaking is £6,429,895, on which we are entitled by Act of Parliament to pay a dividend of 4 per cent., and to charge 3s. 1d. per 1000 cubic feet for our gas. As an inducement to economical working, we are allowed by Parliament to pay 2s. 8d. per cent., for each penny by which we reduce the price of gas; and by our co-partnership scheme we pay every employee ¾ per cent. extra on his wages for every such penny reduction. The present price at which we are selling gas is eleven pennies below the standard; so capital in our case receives £1 9s. 4d. per cent. as premium for good working, and labour 8¼ per cent. upon its wages whatever their various rates may be. The scheme has been in existence since 1889, and £548,708 has been distributed among employees as a bonus to their wages. The employees actually hold to-day shares which have a market value of £352,743, in addition to which many have used the bonus for the purchase of houses or to set themselves up in our Colonies beyond the sea, where many are doing well. I may say that so far from a co-partner being less mobile by reason of his partnership, he is potentially more so. One can move about the world with greater freedom by having money in one's pockets than if they are empty.

What has been the result to the Company of this co-partnership? For 22 years we have had unruffled industrial peace. Our men do their work with good will, and intelligently enter into the requirements of their duties, whether fixed or changing by circumstances. Think of the difference between a willing and an unwilling worker, What percentage in value might it not reach? Our men carry the flag of our business all over the area we supply with gas. What must it not be worth to us to have the thousands of jobs necessary in the houses of consumers of gas performed by men who have an interest in our business and are attached to us, rather than by (as is too often the case) covert enemies? We constantly receive evidence that this is actually so. We get the use of our men's brains as well as their muscles; and whenever difficulties arise connected with the supply or use of gas, they are always ready to give the undertaking the benefit of the experience which so often in technical matters can only be obtained by intimate day-by-day association with the many operations involved in them.

What is the effect of co-partnership upon the flotsam and jetsam of labour? Undoubtedly, to reduce it. Give a man an inducement to interest himself in his occupation, and he will be less liable either to feel or to excite dissatisfaction. He will be less prone to throw up his employment and seek service elsewhere—too often with the result that he is walking about the streets swelling the ranks of the unemployed.

The late Lord Derby said:

> It is human nature that a man should like to feel that he is to be the gainer by any extra industry that he may put forth; that he would like to have some sense of proprietorship in a shop, or a mill, or whatever it may be in which he spends his days; and it is because the system—introduced of late years—of co-operative industry—meets this natural wish that I look forward to its extension with so much hopefulness. I believe it to be the best and surest remedy for the antagonism of labour and capital which we hear so much talked of, and which to a certain extent no doubt exists. I am well aware that such a state of things as I have pointed out is one which cannot be brought about in a day. It is quite probable that there are some trades and some kinds of businesses in which it cannot be brought about at all; but it seems to me that it is in this direction that the efforts of the best workers and the ideas of the best thinkers are tending, and we are not to be disheartened by a few failures.

Well, in the particular branch of industry with which I am connected—namely, gas supply—it has been an undoubted success. Thirty-one companies, with a capital of over forty-seven millions sterling, have adopted the principle of co-partnership; and it is continually extending. When my own Company's scheme was started in 1889, it excited bitter opposition from capitalists and workmen alike; and for eleven years the voice of its originator, the late Sir George Livesey, was crying in a wilderness, where employer and employed turned a deaf ear to his teachings. But gradually the indisputable advantages achieved by it began to force consideration, with the results I have endeavoured, but imperfectly, to indicate.

I do not think I can better draw to a close the brief expression of co-partnership I have been able to give you than by quoting one of the most recent important utterances upon the subject. In the early part of this year, Mr. George W. Perkins, a Director of the United States Steel Trust and of several American Railroad Corporations, wrote:

> Co-operation between labour and capital cannot be effected by the paying of wages and by the giving of gratuities or voluntary rewards at the end of the year. The great educational system of this country [America] has made tremendous strides in the last quarter-of-a-century in developing the independent thinker among the masses, with the result that the question between capital and labour to-day is not so much the amount of wage a man should be paid, as whether that wage is a fair proportion of the earnings of the business. Where this has been tried, it has been eminently successful; and as the question is simply one of handling human nature, what can be done in one line of business can be done in another.

BRITISH COMMERCIAL GAS ASSOCIATION AT WORK.

An Unwarrantable Attack on Gas Effectually Answered.

In the "Manchester Guardian" for the 17th inst. there was a prominent anonymous advertisement, under the heading "The Winter of Discontent," which contained a number of audacious statements in regard to the value of electricity as compared with gas for cooking, heating, and lighting. The advertisement is dealt with in another part of the "JOURNAL," and therefore detailed reference to it is unnecessary here. As might have been expected, the statements it contained roused the British Commercial Gas Association, who followed, in the issue of the "Guardian" for last Thursday, with very striking evidence of their existence in the form of a double-column statement in bold type, headed "Fact *versus* Fiction," in which they set forth their object—viz., not to attack the electrical industry, as there was room and demand for both gas and electricity in the service of the public; but when gas was attacked and libelled in the manner in which it had been in the anonymous advertisement in question, they felt it to be their duty to the public to "state the facts in contradiction to the fiction." This they expressed their intention of doing in the two succeeding issues of the "Guardian."

Faithful to their promise, the Association next day traversed the statements made in the anonymous advertisement. The subject of cooking and heating by gas was first taken up, and all the allegations as to contamination of food and the production of "lethal vapours" disproved. Quotations from the well-known report of the Special Analytical Sanitary Commission of the "Lancet," as well as from the ordinary columns of that paper, were given to show that a properly constructed and fitted gas-stove does not in any way vitiate the air of a room. Some testimonials from eminent medical men in favour of gas-stoves were quoted; and as they could be "added to by the score," the term "lethal," applied to gas-fires, may be stigmatized as an aspersion upon their character. "The writer of the electrical advertisement under notice," said the Association, "is ignorant of his sub-

ject to a surprising degree. If he is not ignorant, he is intentionally seeking to mislead by the suppression of truth."

Having exposed the falseness of the statement that gas-fires are detrimental to health, the Association on Saturday considered the relative cost of gas and electricity for fuel purposes. This bore, of course, upon their use for cooking as well as upon their application to domestic or industrial heating. They begin by pointing out that the relative heating capabilities of any two descriptions of fuel can be determined absolutely; but they are careful to emphasize the fact that "a given quantity of energy or fuel can only yield a certain quantity of heat when consumed, and no more. This heat may be concentrated instead of being diffused, or conserved instead of being dissipated; but it cannot be increased by any possible means." They then make the following remarks on

Cooking by Gas and Electricity.

A ton of coal, a sack of coke, a pound of wood, a kilowatt of electricity, a foot of gas—each, according to its quality, has its precise equivalent in heat units when completely consumed, and no device ever can increase that equivalent. Now, a Board of Trade unit of electricity when completely converted into heat will produce 3410 British thermal units. It cannot produce more, now or hereafter, whatever progress science may make. No progress in science can ever make a pint pot hold more than a pint.

A cubic foot of Manchester gas when completely consumed will produce 550 B.Th.U. At 2s. 3d. per 1000 cubic feet, a pennyworth will buy 37 cubic feet of Manchester gas, having an equivalent of $37 \times 550 = 20,350$ B.Th.U. This is more than five times the amount of heat that can be obtained from a unit of electricity, costing the same (1d.).

You have to waste over 80 per cent. of the heat obtained from a pennyworth of gas before you come down to the quantity of heat represented by a pennyworth of electricity, assuming that you do not waste 1 per cent. of the latter. This is why electric radiators have not been able, are not able, and never will be able, to compete with gas-fires for economical heating. This is why electric cooking-stoves have not been been able, are not able, and never will be able, to compete with gas-cookers for economical cooking. [These two sentences are printed in very heavy type.]

The writer of the electrical advertisement stated that the heat from electricity could be concentrated, while that from gas could not. He has evidently never seen a gas-furnace melting bars of steel. If he will try to stand 12 inches in front of a gas-fire burning one pennyworth of gas per hour as long as another man can stand the same distance in front of an electric radiator costing the same amount, he will learn something about the concentrated heat obtainable from gas.

Recent careful experiments have proved that the cost of cooking joints of equal weight by electricity at 1d. per unit and gas at 2s. 3d. per 1000 cubic feet, is as 4 : 1; of boiling water, as $3\frac{1}{2}$: 1; and of cooking pastry, as $3\frac{1}{2}$: 1. The loss of weight in the joints was as nearly as possible identical in both cases. As every cook of any experience knows, if you want to preserve the weight of meat to the fullest possible extent in a gas-oven, you use a casserole or some other type of inner oven, or a paper bag. If you prefer your meat very well done and "browned-up," you roast it in the open oven. For want of this elementary knowledge of cookery, some experimenters with gas and electric ovens have gone badly astray, and are seeking to lead the public after them.

As the placing of a joint in a gas-oven that has been heated to the proper temperature effectually seals up the pores of the meat, through which the escaping steam and dripping have subsequently to force their way outward, the suggestion that the "fumes" from the gas can contaminate the meat is a figment of a distorted imagination. This point was investigated by hygienists nearly half-a-century ago.

The Association conclude by again emphasizing the fact set forth in their first advertisement, that they have no desire to attack the electrical industry; their object being to extend the gas business, not to injure any other. But they declare that they are prepared to defend with all their power the gas industry from "attacks founded upon false assertions."

SHEFFIELD UNITED GAS COMPANY.

An Example of a Well-Managed Private Monopoly.

Practically the whole of the Engineering Supplement to "The Times" last Wednesday was devoted to Sheffield and its industries. It was pointed out that the city presents a striking example of the vast strides made in the commerce of this nation during the past hundred years. To-day, it has a population numbering 454,653 within the 23,662 acres comprising its area, and stands forth as the premier city of Yorkshire—a position until recently held by Leeds. Yet there is the record that in 1810 the inhabitants of Sheffield numbered only 52,000, and further back, in 1615, the total was 2207, of whom 725 were "dependent on charity for a bare existence." Referring to the growth and the present position of the Gas Company, the following remarks were made.

The only monopoly in Sheffield not owned by the Municipality is the gas undertaking; and in face of the splendid management of many years past, he would be a bold man who stood on any local public platform and advocated purchase by the community. The early days of the Company were somewhat stormy; and not until the middle of the fifties did calmer times arrive. The streets of Sheffield had been first lighted by gas in 1819; and the charge to consumers was at the rate of 12s. per 1000 cubic feet. When a new company entered on the scene in 1834, there was a keen cutting of prices; and the figure was reduced to so little as 4s. 2d. In 1844, the old and new companies amalgamated, and became what is now the Sheffield United Gaslight Company. There was fresh opposition, however, in 1850, when various members of the Town Council promoted a Gas Consumers' Company, and began business before receiving parliamentary sanction. The result was that the premier Company set men to smash up the newly-laid mains, and legal proceedings, which extended over three years, were undertaken. On the suggestion of a Committee of the House of Commons, the two Companies were amalgamated; and from that day there has been no disputing the monopoly. For the shareholders there has been a regular dividend of 10 per cent.—the maximum allowed by law—for the consumer gas at a price which is, with one exception, the lowest in the kingdom. By the latest scale of charges, small consumers pay 1s. 3d. per 1000 cubic feet, and, in proportion to quantities, the price may run as low as 11d. It is almost needless to add that much of this success is due to the perfect development of the production and sale of bye-products—marked indications of efficient management by every one associated with the Company.

Referring to the famous sons of Sheffield, it is stated that "men of the type of the late Sir F. T. Mappin [the Chairman of the Gas Company] and the late Sir Henry Stephenson will be always linked in the mind and heart of every member of the community. Both had the honour of being granted the freedom of the city on its first conferment; and they left behind them a fine example of sterling devotion to the calls of civic duty."

SINGAPORE MUNICIPAL GAS UNDERTAKING.

Engineer's Report for 1910.

We have received from the Gas Engineer of the Singapore Municipality (Mr. J. P. Hallaway) his report on the working of the undertaking in the year to Dec. 31 last, accompanied by the accounts for this period, prepared by Mr. J. Polglase, the Municipal Secretary. They furnish the following particulars.

The quantity of gas made was 89,293,200 cubic feet; being an increase of 17·5 per cent. on the make in 1909. Since the works were acquired by the Municipality in 1901, the annual production has risen from 44,659,200 cubic feet in 1902 to the quantity stated. For public light ing, 40,653,992 cubic feet (rather less than the total make in the first year of municipal management) were used; being equal to 45·5 per cent. of the gas sent out, compared with 49·2 per cent. in 1909. The amount received for gas used for public lighting was $2·48 per 1000 cubic feet, which covers the cost of gas, the maintenance of mantles and chimneys, and all charges, including the cost of new lamps. There were erected last year two "thermopile" lamps, each of 1200-candle power, two Lucas clusters of 1800-candle power each, and a Lucas lamp of 700-candle power. There were 44,270,056 cubic feet of gas sold for private lighting, compared with 35,304,488 cubic feet before—an increase of 25·4 per cent. For the first time since the works were taken over, the gas sold for private use has exceeded the quantity supplied for the public lamps. In 1902, the private consumption was 13,339,558 cubic feet, or only 30 per cent. of the output; whereas last year it was 49·6 per cent. There was a reduction in price from the 1st of July, and it resulted in a number of small consumers using gas instead of oil. The prices of $3, $2·75, and $2·40 were brought down to $2·70, $2·55, and $2·25. But Mr. Hallaway considers the charge is still too high; and he is confident that a further reduction, which he says the Municipality are in a position to make, would result in greatly increased sales, and strengthen their position to meet competition from other kinds of lighting.

Turning to the particulars of working, 7082 tons of coal (four kinds from Australia, two from India, and one from Japan) were carbonized; and the make of gas per ton was 12,608 cubic feet, of which 12,150 cubic feet were sold. The make per mouthpiece was 5650 cubic feet. The residuals produced were: Coke, 4053 ton 15 cwt., or 11 cwt. 44 lbs. per ton of coal; and tar, 83,343 gallons, or 11.7 gallons per ton of coal.

The accounts of the undertaking show that the sale of gas for private consumption produced $138,997; and for public lighting, $108,665; meter-rental came to $4111; residuals produced $48,129; and the total revenue was $319,229. The expenditure on the manufacture of gas was $102,167; on distribution, $37,328; public lighting expenses were $19,815; management cost $14,660; and the total expenditure was $189,747—leaving a balance of $129,482 to go to the net revenue account. After paying interest on the loan, and making contributions to the sinking and municipal funds and the depreciation account, there was left a balance of $44,558 to be carried forward.

Goole Gas-Workers' Dispute Settled.—In last week's issue, it was reported that the employees at the Goole Urban District Council's gas-works had threatened to come out on strike because one of the lamplighters refused to join the Union of which the other men are members. A special meeting of the Gas Committee was called; but before it could be held, the dispute had been terminated by the outstanding man making application for admission to the Union.

Continental Union Gas Company, Limited.—In the report to be submitted by the Directors of this Company at the ordinary general meeting next Tuesday, they state that negotiations are still in progress with reference to Messina. During the year ended June 30 last, the Union des Gaz secured the concessions of four communes contiguous to Strasburg, and also those of several outside Milan; and the concessions of Greco, Affori, and Musocco, near the latter city, were renewed. The increase in the sales of gas for the year exceeded 5 per cent. The private consumers were augmented by 15,596 (making a total of 288,499); and the public lamps by 377—making, in all, 28,131. The mains were increased by 32 miles; bringing up the total length to 1259 miles. The amount charged to capital account was £63,457. The Union des Gaz is distributing the same dividend as last year—viz., $7\frac{1}{2}$ per cent., and, after adding £8000 to the special reserve fund, is carrying forward £15,698, as against £14,556 last year. Referring to the Continental Union Gas Company's accounts, the Directors state that a further sum of £10,000 has been written off the Messina outlay account. The net profit available for distribution is £56,243, from which the Directors recommend a dividend for the year of 7 per cent. on the preference stock, less income-tax, and of 4 per cent. on the ordinary stock, free of income-tax—carrying forward £11,059, against £11,783 last year.

GLOVER-WEST VERTICALS FOR NELSON.

A scheme of the Nelson Town Council for the improvement of the gas undertaking was placed before Mr. F. O. Stanford, an Inspector of the Local Government Board, last Tuesday, in connection with an application for sanction to borrow £21,650. It was stated that this was the first inquiry in England relating to the particular kind of plant proposed to be installed by the Corporation—viz., Glover-West vertical retorts. There was no opposition.

The Town Clerk (Mr. J. H. Baldwick) furnished some statistics and particulars—stating that the Leeds Road gas-works were acquired in 1866 by purchase from the Nelson Gas Company; the present retort-house, then half the size, being included. The Corporation also owned gas-works at Brierfield, acquired in 1890, and since then extended from time to time. Combined, the output of the two works in 1901 was 227,313,000 cubic feet; and in 1911, it was 350,734,000 cubic feet. It was anticipated that next month the capacity would be taxed to the full in meeting the demand created by the increased activity in the cotton trade, and the consequent erection of more mills.

Mr. A. Morton Fyffe (the Gas Engineer) explained the construction of the proposed new retorts; and he claimed that the improved method of gas manufacture in vertical retorts would ensure a purer atmosphere in the centre of the town. It was, he said, proposed to erect an entirely new retort-house, to accommodate five beds, each of eight Glover-West vertical retorts. The new house would adjoin the present one; and the latter would, after the completion of the scheme, be converted into a coal-store. The installation would enable them to carbonize 110 tons of coal per day; whereas the present capacity was 70 tons. The conditions of labour would be far superior to those obtaining with any other system of carbonization; the absence of intricate machinery would render the wear and tear and renewals inexpensive; while the quantity of naphthalene in the gas would be reduced to a minimum.

GAS SUPPLY IN NEW MILLS COUNCIL'S OUT-DISTRICTS.

For some time the inhabitants of Disley, near New Mills, have been agitating for a better supply of artificial illumination for the district than is at present obtained; and a petition on the subject, signed by 373 householders, was recently presented to the Disley Rural District Council. The centre of the Disley district is at present lighted by oil-lamps; and these are used in even the Parish Church. At the last meeting of the Disley Council, a deputation was present from the New Mills Council with reference to that authority extending their gas-mains to Disley, and supplying the district with gas. The deputation, which included the Manager of the New Mills Gas-Works (Mr. P. Lancashire) and the Clerk (Mr. J. Pollitt), produced a map showing the area proposed to be served, involving the laying of about four miles of mains. It was explained that the New Mills Council were prepared to put down these mains, with the necessary service-pipes, and supply gas at an inclusive charge of 3s. 3d. per 1000 cubic feet to consumers by ordinary meters, and 3s. 9d. for slot-meter users and for the public lamps. This was 9d. per 1000 cubic feet more than the price charged at New Mills; but it was pointed out that in the case of any reduction in the charges there a corresponding reduction would be made to Disley. In answer to a question, Mr. Yates, the Chairman of the New Mills Council, said the idea was that the price of gas supplied to Disley would always be 9d. per 1000 cubic feet more than that charged at New Mills. The Council's mains were laid to the Newton end of the Disley district, and no increase would be made to the consumers there. Mr. Pollitt also read a clause which the New Mills Council were prepared to insert in their Provisional Order, subject to the sanction of the Local Government Board. It was a clause under which the Disley Council could purchase from the New Mills Council the portion of the plant and undertaking within the Disley Council's district, on giving six months' notice of their intention to do so. The deputation were thanked for the information supplied, and advised that the Disley Council would deal with the matter, probably at the next meeting. On the Furness Vale side of the Disley district, gas is at present supplied from the Whaley Bridge Gas-Works.

PRESENTATION TO MR. C. F. RUGGLES.

In recognition of his services as Captain of the Leighton Buzzard Fire Brigade, Mr. C. F. Ruggles, the Manager and Secretary of the Leighton Buzzard Gas Company, was lately presented with a testimonial, subscribed to by nearly 300 of the residents in the town and other friends. Unfortunately, ill-health prevented him from receiving the testimonial publicly, much to the general regret; and it was accordingly handed to him at his residence. It took the form of a leather-bound album containing the names of the subscribers, a gold watch-bracelet for Mrs. Ruggles, and the balance of the fund in a purse of gold. The preface to the album set forth that the book bore testimony to the services rendered to the town and neighbourhood by Mr. Ruggles as officer commanding the local Fire Brigade from July, 1885, to August, 1911, a period of 26 years—to whose voluntary efforts the state of high efficiency to which the Brigade had attained was mainly due. It was intended to mark the esteem in which Mr. Ruggles was held by his fellow-townsmen, as a tribute to the high probity of his character, and to the single-hearted loyalty he had shown in his self-imposed task of saving life and property during so long a period. Reference was likewise made to the small token of regard presented to Mrs. Ruggles; the subscribers recognizing that "the arduous and dangerous duties of a fireman fall not on himself alone, but are shared by those who wait anxiously at home for his safe return." The album also contained a short history of the Fire Brigade. When the presentation was made, Mr. Ruggles said he regretted that he was unable then to express his thanks to the subscribers.

Referring to the presentation, the writer of the "Local Chat" in the "Leighton Buzzard Observer" characterized it as "one of the pleasantest events of the whole year." He added: "After all, there is gratitude in the public mind for long service faithfully rendered; and Mr. Ruggles has the comfort of knowing that the testimonial is a genuine, not a formal, acknowledgment of thousands of hours of work which was generally arduous and often dangerous. The good wishes of the subscribers, and of the public generally, accompany the presentation, coupled with the hope that Mr. Ruggles may speedily be restored to health."

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 587.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct. 12	5	Alliance & Dublin Ord.	79—82	..	6 1 11
374,000	Stk.	July 14	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
250,000	5	Sept. 28	7	Bombay, Ltd.	6—6½	..	5 7 8
50,000	10	Aug. 31	15	Bourne-mouth Gas & Water	B 10 p.c.	..	5 1 8
311,810	10	,,	7		B 7 p.c.	..	4 3 7
75,000	10	,,	6		Pref. 6 p.c.	..	4 1 4
380,000	Stk.	Aug. 16	13	Brentford Consolidated	256—261	..	4 19 7
330,000	,,	,,	10	Do. New	198—203	..	4 18 6
50,000	,,	,,	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
206,250	,,	June 15	4	Do. 4 p.c. Deb.	98—100	..	4 0 0
220,000	Stk.	Aug. 31	11	Brighton & Hove Orig.	217—222	..	4 19 1
246,320	,,	,,	8	Do. A Ord. Stk.	156—159	..	5 0 8
490,000	20	Sept. 28	12½	British	44½—45½	..	5 9 11
120,000	Stk.	June 30	4	Do. 4 p.c. Deb. Stk.	94—96	..	4 3 4
109,000	,,	Aug. 16	6	Bromley, A 5 p.c.	127—132	+10	4 10 11
165,700	,,	,,	4½	Do. B 3½ p.c.	97—102	+8½	4 8 3
82,278	,,	,,	5½	Do. C 5 p.c.	117—122	+12	4 10 2
55,000	,,	June 30	3½	Do. 3½ p.c. Deb.	82—84	..	4 3 4
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	95—97	..	4 2 6
100,000	10	—	—	Cape Town & Dis., Ltd.	2—3	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4½—5½	..	—
100,000	Stk.	June 30	4½	Do. 4½ p.c. Deb. Stk.	80—83	..	5 8 5
157,150	Stk.	Aug. 16	5	Chester 5 p.c. Ord.	111—113	+1	4 8 6
1,518,280	Stk.	,,	5/9/4	Commercial 4 p.c. Stk.	110—112	..	4 17 7
560,000	,,	,,	5½	Do. 3½ p.c. do.	105—107	..	4 19 8
475,000	,,	June 15	3	Do. 3 p.c. Deb. Stk.	76—78	..	3 16 11
800,000	Stk.	May 31	4	Continental Union, Ltd.	90—95	..	4 4 3
200,000	,,	,,	7	Do. 7 p.c. Pref.	135—137	..	5 2 2
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk.	104—105	..	3 16 2
840,150	10	July 28	10	European, Ltd.	19½—20½	..	4 17 7
16,16,600	Stk.	Aug. 16	4/14/8	Gas-light and Coke	4 p.c. Ord.	104½—105½	..	4 9 9
2,600,000	,,	,,	3½		3½ p.c. max.	84½—86½	..	4 0 11
4,062,235	,,	,,	4		4 p.c. Con. Pref.	102—104	..	3 16 11
4,531,705	,,	June 15	3		3 p.c. Con. Deb.	80—82	..	3 13 2
258,740	Stk.	Sept. 14	5	Hastings & St. L. 3½ p.c.		94—96	..	5 4 2
82,500	,,	,,	6½	Do. do. 5 p.c.		—	..	—
70,000	10	Oct. 12	11	Hongkong & China, Ltd.		17—17½	..	6 5 9
131,000	Stk.	Sept. 14	7½	Ilford A and C		154—157	..	4 15 6
65,780	,,	,,	6	Do. B		125—128	..	4 13 9
65,500	,,	June 30	4	Do. 4 p.c. Deb.		94—96	..	4 3 4
4,940,000	Stk.	Nov. 10	9	Imperial Continental		183—185*	..	4 17 3
1,235,000	Stk.	Aug. 16	3½	Do. 3½ p.c. Deb. Red.		90—92	..	3 16 1
200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c.		125—130	..	4 12 4
561,000	Stk.	Aug. 16	10	Liverpool United A.		218—220	..	4 10 11
718,100	,,	,,	7	Do. B.		164—166	..	4 4 4
306,083	,,	June 30	4	Do. Deb. Stk.		102—104	..	3 16 11
75,000	5	June 15	6	Malta & Mediterranean		4½—5½	..	5 17 1
560,000	100	Oct. 2	5	Met. of 5 p.c. Deb.		100—102	..	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.		100—102	..	4 8 3
541,920	20	Nov. 10	3½	Monte Video, Ltd.		12—12½*	—½	5 12 0
1,775,892	Stk.	July 28	4½	Newc'tle&G'tesh'd Con.		101—102	..	4 5 9
529,705	Stk.	June 30	3½	Do. 3½ p.c. Deb.		87—89	..	3 18 8
55,940	10	Aug. 31	7/7/0	North Middlesex 7 p.c.		14½—15½	..	4 14 10
300,000	Stk.	Apl. 27	8	Oriental, Ltd.		138—140	..	5 14 4
60,000	5	Sept. 28	8	Ottoman, Ltd.		6½—7	..	5 14 4
31,800	53	Aug. 16	13	Portsea Island A		140—145	..	4 14 10
60,000	50	,,	13	Do. B		133—138	..	4 14 2
100,000	50	,,	12	Do. C		130—135	..	4 8 11
398,490	5	Oct. 12	8	Primitiva Ord.		7⅞—7⅞	..	5 4 11
796,980	5	June 30	5	Do. 5 p.c. Pref.		5⅛—5⅝	..	4 13 0
488,900	100	June 1	4	Do. 4 p.c. Deb.		97—99	..	4 0 10
312,650	Stk.	June 30	4	River Plate 4 p.c. Deb.		95—97	..	4 2 6
250,000	5	Sept. 28	12	San Paulo, Ltd.		10½—11	..	5 9 1
115,000	10	,,	6	Do. 6 p.c. Pref.		11½—12	..	5 0 0
125,000	50	July 1	5	Do. 5 p.c. Deb.		50—51	..	4 18 0
135,000	Stk.	Aug. 31	10	Sheffield A		238—240	..	4 3 4
209,984	,,	,,	10	Do. B		238—240	..	4 3 4
523,500	,,	,,	10	Do. C		238—240	..	4 3 4
90,000	10	Sept. 28	6	South African		8—9	..	6 13 4
6,429,895	Stk.	Aug. 16	5/9/4	South Met., 4 p.c. Ord.		116—118	..	4 12 8
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.		79—81	..	3 14 1
209,820	Stk.	Aug. 16	8½	South Shields Con. Stk.		155—157	..	5 8 3
605,000	Stk.	,,	5⅝	S'th Suburb'n Ord. 5 p.c.		121—123	+2	4 12 0
60,000	,,	,,	5	Do. 5 p.c. Pref.		117—120	..	4 3 4
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.		121—123	..	4 1 4
502,310	Stk.	Nov. 10	5	Southampton Ord.		106—108*	..	4 12 7
120,000	Stk.	Aug. 16	7½	Tottenham A 5 p.c. and B 3½ p.c.		145—148	..	4 16 3
483,940	,,	,,	5⅝			115—117	..	4 16 1
149,470	,,	June 15	4	Edmonton 4 p.c. Deb.		96—98	..	4 1 8
182,380	10	June 15	8	Tuscan, Ltd.		8¾—9¼	..	8 13 0
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.		96—98	..	5 2 0
236,476	Stk.	Aug. 16	5	Tynemouth, 5 p.c. max.		113—115	..	4 6 11
255,636	Stk.	Aug. 31	6⅝	Wands-worth B 3½ p.c.		142—145	..	4 14 10
85,766	,,	June 30	3		A 3½ p.c. Deb. Stk.	73—75	..	4 0 0

Prices marked * are "Ex. div."

MANCHESTER SMOKE ABATEMENT CONFERENCE.

During the Smoke Abatemen Conference at Manchester last week, on the occasion of the annual meeting of the Smoke Abatement League of Great Britain, a good deal was made of the argument that if gas and electricity were to be sold more cheaply—especially for heating and power purposes—a great step forward would be recorded in the campaign of the League for a purer atmosphere in our cities and towns.

The Lord Mayor of Manchester (Mr. S. W. Royse), who presided at the opening sitting of the conference, held in the Town Hall on the Tuesday afternoon, and extended a welcome to the delegates—numbering over sixty, and coming from all parts of the kingdom—led the way; and the suggestions he made in the course of his remarks, to the Manchester Gas Committee in particular and the members of the City Council in general, were greeted with the utmost enthusiasm. Manchester, he declared, was doing everything it could to mitigate the black-smoke evil; and he inclined to the opinion that at present the greatest offender was the domestic fire-place, and not the mills and workshops. It was the duty of the governing authority to consider what could be done to improve matters so far as the domestic hearth was concerned. He had been told that something like 70 per cent. of the heat from the coal used in houses was lost by going up the chimney; and he considered that if gas and electricity could be sold at a less price than at present, a great many people would be induced to abandon the coal-fire. The ingenuity of man was not yet exhausted; and the cheaper gas was produced and sold, the more of it would be used for domestic as well as power purposes. In Manchester, they had taken a wide view in regard to the charges and supply of electricity; and the Electricity Department were selling current for motive power at less than was charged for lighting. This was a course of action he thoroughly agreed with, because, for one thing, they could not store electricity as they could gas. In Manchester they were moving in the right direction, for they were not only supplying gas cookers and grillers free, but gas-fires on hire or on hire-purchase. These concessions, however, were not alone going to solve the problem. He hoped the Gas Committee would at an early date take the whole matter into consideration, and review the cost of production and the cost of gas for heating as well as for cooking purposes.

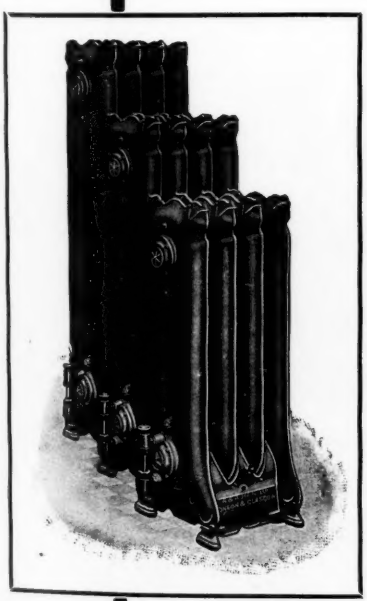
In the course of his Presidential Address, Mr. A. G. C. Harvey, M.P., of Rochdale, this year's President of the League, said that science was coming to their aid in combating the smoke evil; and some of those connected with the League wanted to hasten the improvements by legislation. As a matter of fact, a draft Bill would be submitted to the conference to improve and enforce the existing laws on the subject.

Mr. Ernest D. Simon, Hon. Secretary of the League, explained the object aimed at, and then had a tilt at the Manchester Corporation. In many ways, he said, the Corporation of Manchester were most progressive; but their action in regard to the gas undertaking and its administration left much to be desired. Gas was at present sold in the city for 2s. 3d. per 1000 cubic feet; and this price included a profit of 2d., and a direct contribution of 2d. to the rates. Gas ought to be sold at considerably less. This would be one way of increasing the sales and of cleansing the atmosphere. If the Corporation would forego the profit of £50,000 a year made on gas, they would be going far towards doing away with the loss of at least £700,000 a year caused by smoke. He was well aware that the average ratepayer was apt to put actual reduction of the rates before anything else; but surely it would pay every ratepayer over and over again to forego this large contribution from the Gas Committee in an honest endeavour to render Manchester a city fit for rational human beings to live in.

Principal J. W. Graham, M.A., of Dalton Hall, Manchester, explained the provisions of a Bill which it is hoped Mr. Harvey will introduce to Parliament. There is in it a proposal of a maximum fine of £5, with the right of the Magistrates to double the amount after every offence up to a maximum of £50. Another clause provides for the creation of a separate local authority to deal with the smoke nuisance. In the discussion which followed, the proposed creation of an outside authority to deal with the smoke nuisance came in for a good deal of criticism.

At the second day's sitting, the question of the price of gas was again raised, on a paper read by Bailie W. B. Smith, of Glasgow, who had for his subject "Domestic Smoke." In the discussion which followed, nearly every speaker had something to say in condemnation of the system under which large sums are demanded from gas departments of corporations out of profits in relief of the rates.

At the outset, Bailie Smith submitted the result of a number of experiments to prove that most of the smoke found in the atmosphere was produced from domestic fireplaces and not from factory or workshop chimneys. Therefore, he said, if they could get rid of the domestic smoke, they would immediately have solved the larger part of the problem; and he believed this could be accomplished without recourse to legislation of any kind, by supplying the public with smokeless fuel, both gaseous and solid, at reasonable prices. It was, however, to the use of gas that they must look for the first improvement. Gas undertakings had been long established, and their mains were laid through nearly all the streets, and into all the houses of the working classes and the majority of the houses of the middle and upper classes; and it was quite certain that if the people could be supplied with gas at a price somewhat comparable with coal, convenience alone would induce many to use gas in preference to coal for heating and cooking. Gas-works ought also to supply a much better form of coal residue than the ordinary gas-works coke or char; and he was convinced that this was the line on which those in charge of gas undertakings would work in the future. They must supply a cheap, efficient gas for the up-to-date people who would use gas appliances, and also a smokeless fuel that could be burned in old-fashioned grates by those who in the meantime had a prejudice against using gas, or who could not afford to buy or hire new grates and appliances. A considerable profit would be made by the sale of the smokeless fuel; and this



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would go to lower the price of the gas. He was surprised that managers of gas-works seemed to be slow to experiment in this direction. Then there was another hindrance to progress to be got rid of, and that was the unfair and financially unsound method that many corporations adopted of charging gas at a higher price in order to make what they called a profit or surplus which was used for the relief of the rates. How any community could tolerate such a thing, one could hardly understand. In Manchester last year, for example, the Corporation took £50,000 from the Gas Department for the relief of rates. Had they allowed their Gas Department to charge a legitimate price, gas in Manchester would have been 2¼d. per 1000 cubic feet lower. Glasgow did not take any surplus from either the Gas or Electricity Department in aid of the rates, but sold these commodities to the consumers at cost price. This method of contributing to the rates did not lower the rates in reality, but only altered the incidence of taxation. It meant that the householder who had fitted his premises with gas heating and cooking appliances, and thus kept the atmosphere pure, was compelled to pay more in rates; whereas his next-door neighbour, by continuing to burn raw coal in the old-fashioned way, really paid less in rates, while helping to poison the atmosphere for himself and the community.

The discussion which followed was opened by Mr. Edwin Squire, of Belfast, who said the ratepayer had a right to a proportion of the earnings of the Gas Department, always provided that the price charged for the gas was reasonable. Though a householder might not use gas himself, it was on his credit as a ratepayer that the capital was borrowed; and therefore he had a right to come in as a shareholder. If people were to use gas-fires more than was done now, they must have gas at less than 1s. 11d or even 1s. 8d. per 1000 cubic feet.

Councillor J. Johnston, J.P., of Manchester, a member of the Executive Committee of the League, said he had always argued that gas should be sold as cheaply as possible, so as to encourage its extended use. While agreeing that it was wrong in principle to take profits in relief of the rates, he did think that the city were entitled to charge something for wayleaves from gas and other undertakings making use of the streets.

Councillor W. T. Jackson, also of Manchester, pointed out that wayleaves would not materially affect finance. The policy of earning profits on any department for the relief of the rates was a bungling one, because it either gave no relief at all or only relieved one section of the community at the expense of the other. The ratepayers had not found the money for the gas or any other undertaking of the Corporation; and even if the money had been raised on the credit of the ratepayers it did not give them a claim, for the people who really paid the rates were not only the owners of rateable property, but every man and woman in the city. Something like £3,000,000 had already been paid over in Manchester in relief of rates, which was £200,000 more than the total cost of the undertaking; and if this sum had been devoted to a reduction of the price of gas, the charge to-day would not be 2s. 3d. but 1s. 6d. per 1000 cubic feet. The reason they were not allowed to make a profit on the water undertaking of the Corporation was because of the importance of it to the public. He thought gas ought to be regarded in the same way, and supplied to consumers at about cost price.

Replying upon the discussion, Bailie Smith remarked that the ratepayer on whose credit the money was borrowed was protected by the existence of a statutory sinking fund for the clearing off of the debt on the undertaking. As to the point which had been raised about the cost of gas-fires, compared with the use of coal, he had found that, taking them all the year round, gas-fires for domestic use were not more than 10 per cent. dearer than coal-fires—no allowance being made in this calculation for the large amount of extra labour involved in the use of coal.

Some further information as to the use of coal and gas fires in similar rooms, and the respective cost, was supplied by Mr. Peter Fyfe, Chief Health Inspector to the Glasgow Corporation. In that city, he said, the Corporation were now compelling all their officials to instal in their various offices and rooms modern gas-fires. In his own office, the gas-stove fitted into the grate where coal had been previously burned. To obtain complete combustion of the gas and get radiancy, he installed a small electric fan, which supplied air at a cost of ¾d. per day of seven hours. With the outside air at 49°, he was able to maintain an equable temperature all over the room (which contained about 3800 cubic feet of space) of 62° for the seven hours at a cost of 6d. for gas, the consumption being at the rate of 37 cubic feet per hour—making the total cost 6¾d. In a room of this size, 65 lbs. of coal were consumed in the same time to keep it comfortable. On account, however, of the excessive draught up the chimney, it was impossible to maintain an equable temperature throughout the room. At 10½d. per cwt., the 65 lbs. of coal cost 6d.; so there was only ¾d. per day in favour of the coal-fire. The gas-fire he had was so constructed that he could, if desired, cook by it and boil water. From his experience in Glasgow, he thought the time was coming when the advocates of raw coal-fires in dwelling-houses would have the last and strongest prop—the economic one—withdrawn from under them.

Other papers were read; and before the conference was brought to a conclusion a vote of thanks was accorded the Lord Mayor and Corporation of Manchester for receiving the delegates and placing the room at the disposal of the League; to the readers of the various papers; and to Mr. J. W. Graham for presiding.

Close of the Exhibition.

The exhibition arranged by the Manchester and Salford Smoke Abatement Society, with the object of demonstrating to the public what can be done in the way of lessening the smoke evil, was brought to a close on Saturday night—having been open for just over a fortnight. The management estimate that the average attendance has been over 3000 daily, and that between 5000 and 6000 people paid a visit to the exhibition on the last day; the hall in the evening being at

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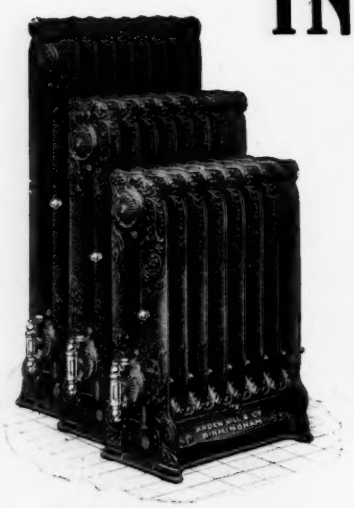

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times inconveniently crowded. Many directly interested in the exhibition expressed the opinion that, had it been extended over another week, the attendance would have been considerably increased, because the public generally were beginning to realize that the exhibits included the very latest devices and apparatus for the application of gas and electricity to lighting, heating, and cooking. During the last week, the visitors included deputations from a number of corporations and officials connected with the gas, electricity, and health departments of their respective cities and towns. That from Glasgow, with Mr. Alex. Wilson, M.Inst.C.E., Gas Engineer and Manager, reached Manchester on the Tuesday, and stayed until the following day for the purpose of gaining further information, in view of the exhibition that is to be held in Glasgow next Autumn.

Shortly before the closing hour on Saturday, those in charge of the stands making a speciality of gas fires, radiators, cookers, &c., on being interviewed, expressed themselves variously as to the amount of business got through. As was to be expected, some had done much better than others in regard to orders booked, and were more than satisfied with the immediate results of the exhibition; and the remainder recorded that the business actually done was "fair" or "good." Mr. A. E. Bretherton, Indoor Manager of the Salford Corporation Gas Department, in the course of conversation, said they had been kept exceptionally busy at their office in the exhibition. A large number of gas-fires had been sold; while what he described as the "serious inquiries" made by consumers in their area of supply about the gas-fires, were certain to result in an extended business in these appliances. He regarded the results as exceptionally satisfactory, especially seeing that his department are handicapped in that they have to sell the gas-fires outright; while their bigger neighbours (Manchester) are now in the position of offering the inducement of simple hire, on the three years' hire-purchase system, to consumers. Some of the callers at the Salford Corporation stand could hardly believe, said Mr. Bretherton, that his central pendant of three lights (Bland's) was really gas illumination, and required a practical demonstration of the fact before being convinced; and the same with a brilliant single light on the front of the stand, operated with an automatic switch. Those in charge of the stand of the Manchester Corporation Gas Department also reported having done remarkably good business, especially during the closing days. That the exhibition has done much to popularize the gas-fire in the Manchester district is evidenced not only by what has been done at the exhibition, but by the orders placed at the Corporation's showrooms in Deansgate during the past fortnight. The pressure on the department for the supply of gas-fires is for the moment somewhat embarrassing; and it will take some time to get level with the orders already given.

The Heathfield and Waldron Gas, Light, and Coke Company, Limited, was registered last Tuesday with a capital of £5000, in £1 shares.

GAS-HEATED HOT-WATER SUPPLY.

A Lecture at Brentford.

A lecture and practical demonstration were given last Tuesday to the staff of the Brentford Gas Company by Mr. Thomas Potterton, on "Gas-Heated Hot-Water Supply"—the matters dealt with including thermostatic control, luminous and non-luminous flames, iron and copper boilers, and comparisons between tank and cylinder systems.

In opening, the author said he advocated the separate boiler and storage arrangement in preference to all others, having by experience, both in outside practice and in the laboratory, convinced himself of the greater utility and general effectiveness of it for ordinary household or trade purposes. As regarded the construction of the boiler, he considered cast iron the most suitable material, principally on the score of lasting power. He was dealing, of course, with hot-water supply as it related to circulating apparatus, and not in regard to instantaneous water-heaters, which met a useful purpose under some conditions. The preference he had for the separate apparatus was primarily on account of the quickness with which a small quantity of hot water could be drawn. In order to demonstrate in a practical manner the quick effect of a properly-designed "separate" system, he had fitted up one of the testing plants supplied by him for general demonstration; and it would be shown that hot water in small quantities, at temperatures ranging from 130° to 150° Fahr. (according to the incoming water), could be drawn in (say) 10 minutes from the time of lighting the gas, instead of heating the whole contents of the cylinder to a high temperature, which was necessary with the combined boiler and storage apparatus, whether there was use for it or not. Further than this, with the separate boiler and storage system, the boiler being an independent vessel, there was no restriction of heating surface as in the other case, which in this detail was confined to the area of the storage. Apart from these points, another of no less importance occurred in the facility afforded by separate boilers for increasing the supply, which frequently exceeded the capacity of a single boiler, even though perhaps for only a short period—such as early morning baths. At first sight, it might seem possible to enlarge the boiler to meet any demand, as with a coke-fired boiler. But upon working out a scheme difficulties would arise; and the only satisfactory solution was to twin the boilers, or form a battery of a number proportionate with the demand. There were no technical or other objections to this arrangement, as the installation, however powerful in heating capacity, produced less hot water as readily and economically as apparatus of the smallest capacity, provided certain principles of construction were adopted.

So far as the question of boiler metal was concerned, it might perhaps appear at first that copper was the better article, on account of its higher conductivity. But against this the question of design had to be considered, for what was practicable in the manufacture of iron goods

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might not be so in copper; and it was principally in this direction that the counter-balancing occurred. Furthermore, after the first heating-up of the metal, whether it was of copper or iron, the transmission to the water was practically the same; so that upon this count the advantages of the two metals in regard to heating propensities might be disregarded. Where, however, the great advantage of iron came in was in the strength obtainable; for, being a commercially cheap metal, the weight was an inconsiderate element. An opportunity had occurred of testing two installations—one composed entirely of iron and the other entirely of copper, each having a No. 18 "Victor" boiler and 20-gallon cylinder. His regular procedure was adopted in these tests—*i.e.*, burning a given quantity of gas in each boiler, and drawing off equal quantities of water (20 gallons), noting the temperatures at which the hottest water was available, and the mean temperature of the bulk. The following were the figures recorded:—

Temperature of cold water. . . . . 53° Fahr.
" " air . . . . . 51° "

	Gas Consumed. Cub. Ft.	Hottest Water. Deg. Fahr.	Bulk. Temp. Deg. Fahr.	B.Th.U. Utilized per Cubic Foot.
First heating—				
Iron apparatus. .	36 ..	149 ..	105·5 ..	388 8/9ths.
Copper apparatus.	36 ..	148 ..	108 ..	407
Second heating—				
Iron apparatus. .	22 ..	146 ..	99 ..	418
Copper apparatus.	22 ..	154 ..	100 ..	427

With regard to the efficiency shown by B.Th.U., the reason for the first reading in each case being less than the succeeding one was that a certain amount of heat was absorbed by the boiler at the commencement, which, in drawing the 20 gallons, was not available, though with an interval of about five minutes, supposing the gas was shut off, the contents of the boilers would circulate into the cylinders and then be available for use. The results of the second heating might therefore be taken as an example of efficiency obtained from a complete apparatus in ordinary use, amounting to fully 80 per cent., which, it was necessary to mention, did not refer to the net efficiency of a boiler, but that of a complete apparatus, allowing for heat losses in circulation and delivery, which represented about 10 per cent. Notwithstanding this, the separate system was more efficient than the "combined," owing to the higher duty performed by the heater.

What he proposed particularly to bring before his audience was a comparison of the tank and cylinder systems, both in regard to working effect and the value of heat obtainable, and a demonstration of the respective advantages and disadvantages of bunsen and luminous flames. It was, he believed, generally known that the cylinder system without any secondary circulation was the most economical form of circulating and storage apparatus, though the extent of the higher duty performed by it in comparison with the tank system might not be known, as, without equal conditions, comparisons were unreliable. In order to afford some practical data, he had erected among various cylinder systems in the testing-room at his works a tank apparatus, such as one frequently met with; and in testing with cylinder apparatus of equal capacity, this had afforded some interesting facts. The apparatus in both cases was suitable for suburban houses or flats rented at £30 to £35 per annum. With the cylinder system the storage was about 4 feet above the boiler, with 9 feet flow and return pipe; while with the tank apparatus the storage was on the first floor, utilizing some 38 feet of ¾-inch circulation. Both had "Victor" boilers and storage of the same capacity; and equal quantities of gas were burnt, and then water drawn off. The first 20 gallons were drawn off when 27 cubic feet of gas had been consumed. In the case of the cylinder system, the hottest water registered 150° Fahr.; and the whole in bulk, 108°. With the tank apparatus, the highest reading was 110° Fahr; and the bulk, 87°. With the tank apparatus, about 7 gallons of hot water was left in the top of the storage vessel. With the tank system, the chief weakness was in the apparatus not delivering the whole of the hot water it contained in a similar manner to the cylinder system. Then it must be apparent that the short flow and return of the cylinder apparatus was more economical than the long run with the tank arrangement, seeing that the heat loss by radiation was minimized. Another disadvantage in having an extended pipe-run was evident in the fact that it must take longer to create a reserve of hot water, if at a useful temperature. These facts go to show that the cylinder system should always be advocated; and in new installations, it doubtless would be adopted. With a gas-boiler fitted to an existing house-service, having perhaps a long circulation, with the tank probably in the roof, and the whole more or less exposed, the working of the boiler must be considerably hampered, the effect displeasing, and the necessity of reconstruction the more apparent. If, however, reconstruction was out of the question, a boiler of larger capacity should be fitted, in order to counter-balance the extra duty required, and ensure a supply being available in about 30 minutes, the same as with a cylinder apparatus. A "Victor" boiler using 80 cubic feet of gas per hour was usually found to answer in a satisfactory manner in houses having tank storage not exceeding 30 gallons; while for larger requirements twin boilers were advisable.

It was important, wherever gas was used, that every endeavour should be made to keep down the consumption; and to this end special attention should be directed in every case to see that the system adopted was suitable, both in power and principle. With an efficient apparatus, it should be possible to obtain hot water at (say) 130° to 150° in 15 to 20 minutes after lighting up, or even in less time for a small quantity at the sink; and any installation that did not afford this convenience, he considered to be at a disadvantage, and unsuitable for general household purposes. It was chiefly on account of slowness of action that constant burning, even at night as well as in the daytime, had been so frequently recommended—the result of which could not be otherwise than detrimental to the gas account. It was not always necessary to keep the gas going constantly, even on the thermostat, as hot water for a bath or other household purposes could be supplied in 15 to 25 minutes; and where, therefore, no demand was

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DAVIS Gas Stove Co., Ltd., LUTON.

likely to occur between morning and evening, or other intervals, why should the apparatus be kept constantly heated, using gas meanwhile to maintain the heat loss by radiation, when the necessary supply was forthcoming in a short time without this continuous waste? In some busy households hot water was in demand at all times; and in such cases he advised that his patent cut-out system be adopted, whereby a reduced reserve was formed by cutting the lower half of the cylinder out of circulation. The heat was then maintained with a much less consumption of gas, and the gas cut down by the thermostat at an earlier moment.

After quoting figures to show the quickness with which hot water for any purpose can be obtained with a No. 20 "Victor" boiler and Potterton's patent automatic cylinder apparatus (having a standard consumption of 80 cubic feet of gas per hour, and capable of supplying four 20-gallon warm baths hourly in summer, and three in winter), Mr. Potterton dealt with the question of bunsen and luminous burners. He said that, in a test of a cylinder apparatus with a "Victor" boiler, he had attained results with a luminous flame very little different from those with the bunsen. This, however, was due to the construction of the boiler, which enclosed the gases, and to the additional surface utilized. The luminous jets were placed so that the flames were 2½ inches clear of the metal, and the whole of the bottom of the boiler was brought into action. Some 20 per cent. additional surface was thus utilized.

The concluding remarks made by the lecturer were as follows: "It is well known that with the luminous type the gas can usually be cut down to a lower consumption than with the bunsen, even to 3 cubic feet per hour, or less, with a burner ordinarily consuming 60 cubic feet per hour; but this is seldom of any material assistance in actual practice, as, except under special conditions, the heat losses by radiation from the apparatus render it necessary to use more—6 to 12 cubic feet per hour frequently being required, according to the dimensions of the apparatus. Very low reduced flames have also the tendency to be extinguished with the slightest draught and variation of pressure; and care should therefore be taken in using them. With regard to the bunsen burners, generally speaking these can be reduced to about one-tenth their normal consumption without lighting-back. Thus, for instance, a 60 cubic feet burner will safely cut down to between 6 and 8 cubic feet per hour, as an example of which a test of a 60 cubic feet Potterton 'Standard' bunsen burner recently carried out by the Gaslight and Coke Company showed that, at a pressure of 45-10ths, with which it consumed 59 cubic feet per hour, it could safely be reduced to 5½ cubic feet without any fear of lighting-back—the gas, incidentally it may be mentioned, containing upon this occasion 25 per cent. of carburetted water gas. It has recently appeared in print that the bunsen type of burner consuming 60 cubic feet per hour cannot be relied upon to work properly cut down lower than 15 cubic feet per hour; while, if water gas is present, it cannot be reduced below 25 cubic feet without lighting-back. The foregoing facts, however, show that such is not the case."

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

At the close of the ordinary business in the Grangemouth Town Council on Monday, Judge Main, the Convener of the Gas Committee, asked permission to speak, and said that at a recent meeting of ratepayers Bailie White endeavoured to make his hearers believe that the Gas Commissioners were just about the worst set, so far as being fair to the poorer class of the community was concerned. He (Judge Main) had stated that other Gas Commissioners in Scotland were just as bad as, if not worse than, they were. Bailie White had challenged him to prove this; and he would now take the opportunity of doing so. Judge Main proceeded to submit a statement of the charges made by burghs of similar size to Grangemouth for gas supplies through prepayment and ordinary meters. In Cambuslang, the charges were: Ordinary meters, 2s. 11d. per 1000 cubic feet; prepayment meters, 3s. 9d.—an increase of 27½ per cent.; Coatbridge, 1s. 10d. and 2s. 4d.—27½ per cent. increase; Forfar, 3s. 1d. and 3s. 11d.—27 per cent. increase; Glasgow, 2s. and 2s. 7d.—28 per cent. increase; Gourock, 3s. 2d. and 4s.—27 per cent. increase; Larkhall, 2s. 11d. and 3s. 9d.—27½ per cent. increase; Edinburgh, 2s. 10d. and 4s.—41 per cent. increase; and in Widnes, which had the reputation of having the lowest price of gas in the country, 1s. 2d. and 1s. 8d.—42 per cent. increase; compared with in Grangemouth 2s. 11d. and 3s. 9d.—27½ per cent. This clearly proved that if they were sinners they were sinners in good company. Bailie White thanked Judge Main for the statement he had made, and asked permission to reply when he had made inquiries regarding the towns which had been mentioned.

The death occurred in a Glasgow institution on Wednesday last of Henry M'Cann, one of ten men who were tried and convicted of being concerned in dynamite outrages which were attempted in different parts of Glasgow in January, 1883. The ten accused were members of a secret society, which, according to the indictment, had among its objects "the overthrow by force and violence of the power and authority of Her Majesty the Queen in Ireland." One of the three counts in the indictment related to the partial destruction by dynamite explosion of a holder at Tradeston. M'Cann, who was sentenced, with others, to penal servitude for life, was liberated on ticket-of-leave thirteen or fourteen years ago. It was on a Saturday night in January, 1883, that the attempt was made to blow up the gasholder. It was very seriously damaged; and the whole of the contents—about 350,000 cubic feet of gas—was lost. A portion of the city was thrown into darkness for a time; but the more serious result of an explosion of gas underground was averted by the prompt flooding of the mains with water. In the course of the evening, the Engineer—the late Mr. Foulis—was able to reduce the seal upon the mains sufficiently to allow of the partial lighting up of the district.

On Wednesday evening, Treasurer Leishman gave an address in

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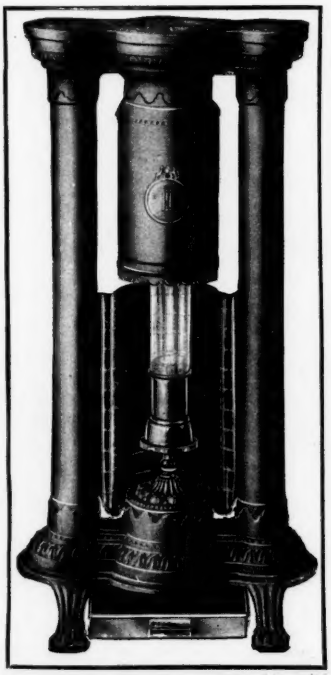

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Edinburgh, under the auspices of the Young Scots Society, upon the subject of "Edinburgh and Industry." In the course of his remarks, he said there was a feeling prevalent that Edinburgh should be made a glorified tea garden—that they should cater for the tourist, that they should not have industries, but should hamper, restrict, and regulate them off the face of the earth. He entirely differed from this view. He held that they should encourage manufacturers by giving them cheap sites and reasonable conditions as to gas, electricity, &c.

A special meeting of the Greenock Town Council was held yesterday, at which a recommendation by the Committee that Mr. J. M'Leod, the Engineer and Manager, be granted an honorarium of £50 for his successful working of the undertaking was agreed to unanimously.

The Aberdeen Town Council on Monday of this week re-appointed Mr. J. A. Sangster Convener of the Gas Committee.

The smoke abatement crusade, so vigorously and so auspiciously begun in Glasgow more than a year ago, is being continued in a spirit which gives reason to look for a no small measure of success. Though there is to be no exhibition this winter, the attention of the public is to be directed, by means of lectures, to the desirability of checking the wholesale emission of smoke which has too long prevailed. One of these lectures was delivered in the Kent Hall, St. Andrew's Halls, Glasgow, on Thursday evening by Mr. George Ness, M.I.M.E., the Chief Engineer of the Scottish Boiler Insurance Company. Mr. F. H. Kitchin, who presided, said Glasgow had discovered with extraordinary rapidity that a very large amount of the soot in the atmosphere was preventable. It followed that if smoke was preventable, a great deal of the disease which arose in consequence of smoke was also preventable. Mr. Ness, in his lecture, said that the price of coal would require to be four-sevenths of the price of oil in order to make the substances of equal value for evaporative purposes. Having dealt with modern power developments purely as a smoke-reduction problem, he expressed the opinion that the future of this question would trend in the direction of the transmission of electricity at a low rate for power purposes from central generating stations, operated by sufficient steam plant, by oil plant, by gases generated from producing plant at collieries, or by waste gases from iron-works; while with smaller units the noxious gases given off in the production of power might be trapped and prevented from entering the atmosphere until they had been rendered less deleterious to the general health of the community.

A lecture, with demonstrations, was delivered last night in the Leith Walk Continuation School, Edinburgh, on the heating of water by a gas-circulator. The lecture was intended for the benefit of the officials and staff of the Distribution Department of the Edinburgh and Leith Gas Commissioners. Mr. A. Masterton, the Engineer and Manager, introduced the lecturer, who showed how 95 per cent. of the available heat in gas could be utilized for raising the temperature of the water to any required degree. He also discussed the construction, working, and fixing of these appliances so as to act in conjunction with, or take the place of, the ordinary coal-range.

CURRENT SALES OF GAS PRODUCTS.

[For Table of "Tar Products Prices," see p. 642.]

Sulphate of Ammonia.

LIVERPOOL, *Nov.* 25.

During the past week there has again been an improvement in the demand, and, although no decided advance in prices has taken place, the tendency has been in an upward direction. Some consumers, both in this country and abroad, who were waiting for lower values, have now decided to cover part of their requirements at the present level, and at the close the tone is very firm at £14 3s. 9d. per ton f.o.b. Hull, £14 5s. per ton f.o.b Liverpool, and £14 7s. 6d. per ton f.o.b. Leith. In the forward position, there has also been more inquiry; but the premium on spot prices demanded by makers has tended to check business. It has transpired, however, that the equivalent of £14 6s. 3d. per ton f.o.b. Liverpool has been paid for equal monthly quantities up to April, 1912.

Nitrate of Soda.

The situation of this article is without alteration, and holders maintain their quotations at 10s. 1½d. per cwt. for ordinary and 10s. 4½d. for refined quality, on spot.

LONDON, *Nov.* 27.

Tar Products.

The markets for tar products continue very firm. In pitch there has been the usual amount of inquiry, but the price remains the same. Benzols are strong for prompt delivery; and high prices are being asked for forward. Solvent naphtha is steady; and enhanced prices are asked in some quarters. The demand continues good for heavy naphtha. Creosote is still very firm; and there is a fair amount of inquiry both for prompt and forward delivery. Crude carbolic remains in about the same position.

The average values during the week were: Tar, 22s. to 26s. *ex* works. Pitch, London, 40s. 6d. to 41s.; east coast, 40s. to 40s. 6d.; west coast, Clyde 39s. to 39s. 6d., Manchester 38s. 6d. to 39s., Liverpool 39s. to 39s. 6d. Benzol, 90 per cent., naked, London 10d. f.o.b.; North, 9¼d. to 9½d. f.o.b.; 50-90 per cent., naked, London, 8d. to 8½d.; North, 8d. to 8¼d. f.o.b. Toluol, naked, London, 9d. to 9½d.; North, 8½d. to 9d. Crude naphtha, in bulk, London, 4¼d. to 4⅜d.; North, 3¾d. to 4d. Solvent naphtha, naked, London, 9¾d. to 10d. f.o.b.; North, 9d. to 9¼d. f.o.b. Heavy naphtha, naked, London, 11½d. to 1s., f.o.b.; North, 10d. to 10¼d. f.o.b. Creosote, in bulk, London, 2¾d. to 3d.; North, 2⅝d. to 2¾d., salty; 2⅝d. to 2¾d., liquid. Heavy oils, in bulk, 3d. to 3¼d. Carbolic acid, casks included, 60 per cent., west coast, 2s. to 2s. 2d.; east coast, 2s. 1d. to 2s. 3d. Naphthalene, £4 10s. to £10; salts, 40s. to 45s., bags included. Anthracene, "A" quality, 1½d. to 1⅝d. per unit, packages included and delivered.

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ALTHOUGH our huge stock of gasfires at the commencement of the season is necessarily much reduced by the continuous and increased demand for our Interchangeable "A.B.C." Series of Gasfires, we can deliver running sizes by return.

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Sulphate of Ammonia.

There has been a dull tone in the market for this article during the past week, but prices remain unaltered. Actual Beckton is still quoted £13 17s. 6d. Outside London makes are £13 10s.; Liverpool, £14 5s.; Hull, £14 3s. 9d. In Leith, the makers are still asking £14 7s. 6d.; and in Middlesbrough, £14 3s. 9d.

COAL TRADE REPORTS.

Northern Coal Trade.

There is renewed activity in the coal trade of the North, now that the supply of collier steamers is more adequate. The collieries are working fully, and the large output appears to be well taken up. Best Northumbrian steam coals are from 11s. 9d. to 12s. per ton f.o.b., second-class steams are from 10s. 3d. to 10s. 9d., and steam smalls are from 5s. to 6s. In the gas coal trade, there is now a more pressing demand, both for home use and for export; and the full output of the collieries is well taken up. Prices are on the whole firmer. Best Durham gas coals are from 11s. 6d. to 11s. 9d. per ton f.o.b.; and second-class gas coals are from 10s. 6d. to 10s. 9d. "Wear specials" are firm at about 12s. per ton, and are rather scarce for early delivery. There are a few sales of cargoes of gas coals to some of the ports of the Mediterranean; but the fact that the rate of freight for the sea voyage to places such as Genoa is now fully 2s. 6d. per ton more than it was three months ago, limits the amount of these sales. No long contracts are reported this week. Coke is firm, and higher in price. Though gas coke is now in heavy production, the price is stronger—at 14s. 6d. to 15s. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

The market continues to go strong, particularly for shipment purposes; but there is a ready sale for all sorts. The prices now quoted are: Ell, 10s. 9d. to 11s. 9d. per ton f.o.b. Glasgow; splint, 11s. 3d to 11s. 6d.; steam, 10s. to 10s. 3d. The shipments for the week amounted to 335,339 tons—an increase upon the preceding week of 40,281 tons, and upon the corresponding week of 22,735 tons. For the year to date, the total shipments have been 14,647,370 tons—an increase upon the corresponding period of 311,842 tons.

South Shields Gas-Workers' Wages.—It is reported that, in response to a demand by their employees, made through the Gas-Workers' and General Labourers' Union, for an all-round advance of wages of 2s. per week, the Directors of the South Shields Gas Company have offered to grant an increase of 1s. weekly to certain sections of the workmen. This offer has been rejected; and the men have applied to the executive of the Union for permission to tender their notices. The matter will come before the executive shortly. Meanwhile a further interview with the Directors has been requested.

Defective Electric Circuit Causes an Explosion.

A serious gas explosion and fire occurred in the Strand shortly before two o'clock last Thursday afternoon, in front of the building which was formerly occupied by Coutt's Bank, and is now owned by the London County Council; the ground floor being let out for shops. The thoroughfare was crowded at the time, and, unfortunately, several cases of personal injury resulted. Seven people were taken to the Charing Cross Hospital for treatment; but only one was detained. Smoke was seen to rise from a manhole giving access to the electric cables under the pavement in front of the Saxone Shoe Company's premises, No. 57, Strand, and a bazaar next door. Firemen were summoned, who, after examining the pavement, ordered all people out of the shop. But before the places were clear an explosion occurred, the pavement was blown up for several yards, and the front windows were shattered. The flames passed under the floors of the two shops and reached the basement of the London County Council department. There the doors were blown down and other damage of a minor character was done. By a liberal use of sand, the flames were extinguished, and a stream of water from a hydrant put out the fire. According to the official report of the Fire Brigade, a defective electric circuit was the cause of the fire, which burnt about 15 feet of cable and damaged a distributing-box, as well as a stretch of pavement 20 feet long and 6 feet wide. The proprietor of a neighbouring jewellery shop said his attention was first attracted by the shop becoming full of smoke, and he saw flames round the electric switch-board. He turned off the switches, and in doing so received a terrific shock.

Accident at Athol Street Gas-Works, Liverpool.—Early last Tuesday morning, while four men at the Athol Street works of the Liverpool United Gas Company were engaged in charging one-half of a purifier-box, the oxide in the other portion fired the gas lying under the cover; and the men were more or less injured by the flame. One of them, however, was able to resume his work; while the others have been progressing satisfactorily towards recovery.

Province of Buenos Ayres Water-Works Company, Limited.—The profits of this Company for the period ended June 30 amounted to £5486, of which the preference dividend took £200. The Directors propose to pay a dividend on the "A" shares for the six months to June of 4 per cent. per annum; leaving £886 to be carried forward. Under sanction by the Board of Trade, the Directors are empowered, for the period of one year from the date of issue of the preference shares, to provide out of capital a sum sufficient to pay 4 per cent. per annum on these shares; so that it has been necessary to take from the profit earned the sum of only £200. On March 15 last, further capital, consisting of 26,000 cumulative 5 per cent. preference shares of £5 each, was issued. The money was partly utilized in discharging the Company's liabilities to date, and the balance is being expended upon further wells, reservoirs, and pumping machinery, necessitated by the increased demand for water over that originally estimated.

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Manchester Gas Charges to Large Consumers.

At Friday's meeting of the Manchester Corporation Gas Committee, a resolution will be submitted by Alderman G. K. Ashton which, if adopted, will place large consumers of gas for industrial purposes in a much better position than hitherto—especially those outside the city area. This course has been adopted by Alderman Ashton because to have moved his resolution in open Council he would—to use his own words—have been guilty of discourtesy and disloyalty to his colleagues. In March last, the Gas Committee adopted a resolution that on and after June 25, 1911, the price of gas "within the city" for manufacturing purposes other than for illumination be charged at 2s. per 1000 cubic feet, provided the annual consumption is not less than 500,000 cubic feet. Alderman Ashton will move that this resolution be amended so that as from the 1st of January next all consumers, "within and without the city," where the annual consumption of gas "on the same premises for any purpose (other than for gas-engines) is not less than 500,000 cubic feet, be allowed a rebate of 3d. per 1000 cubic feet on the amount charged."

Gas-Fires and Resident Staffs.—The following is taken from the "Hospital" for the 18th inst.: "While it is true that some form of central heating is usually fitted nowadays for ward purposes in our voluntary hospitals, the complexity of administration demands that individual fires in the rooms of the various staffs should be readily lit and cleanable. For this purpose, gas-fires suggest themselves; and any hospital officer who consults the catalogue of (say) the Gaslight and Coke Company, will see designs and applied science of kinds designed to meet every kind of application. The series of small separate coal-fires that used to obtain is expensive and administratively difficult. In the quarters of the resident medical officers, and in those allotted to the domestic staff, gas-fires are worth consideration by nstitutional managers."

Portsmouth Water Company.—At the half-yearly general meeting of the Company last Thursday, the Chairman (Mr. W. Grant, J.P.), in moving the adoption of the report, already noticed in the "JOURNAL," commented on the highly favourable work which the Company had accomplished since the last meeting. It had been a record of prosperity; there having been a notable and excellent increase of £2171 in the water-rental, chiefly on the meter service, but also on the ordinary house property. The profits realized in the half year ended June 30 had been £1000 more than in the corresponding period of last year; and after paying interest on the debenture debt, the balance available for dividend was larger by £1276. The Directors had therefore decided to strengthen the reserve fund, and had written down Consols from £80 to £75. The arrears of dividend fund would not be touched until it had reached £1850; and further sums of £500 and £850 would be added when they were able to do so. Colonel C. Lanyon Owen, J.P., secouded the motion; and, after a short discussion, it was carried.

Extensions at Ruthin.

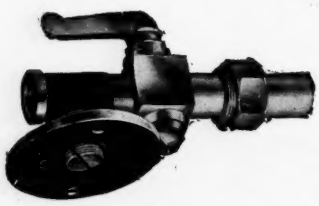
The Directors of the Ruthin Gas Company have for some time past been carrying out, with commendable enterprise, various improvements at their works; the latest addition to the plant being a new retort-house. The work has been under the supervision of Mr. W. E. Brock, of Denbigh; the Contractors being Messrs. Robert Dempster and Son, of Elland. The work carried out consists chiefly of a three-lift spiral-guided gasholder, a purifier, with rubber-jointed cover, and valves in connection therewith, a retort-house 36 feet long by 30 feet wide, and 20 feet high to the eaves, and a retort-bench on the shallow regenerator system, with two settings of six retorts, bench-bracing, and retort mountings, coupled up with the existing plant. The regenerator is of the Brookes patent form. At a dinner given by the Contractors at the Castle Hotel, in celebration of the completion of the extensions, Mr. J. W. Broadhead, of Elland, presided; and a convivial evening was spent.

Salcombe Urban District Council and the Gas-Works.—A Committee appointed by the Salcombe Urban District Council to confer with the Directors of the Gas Company have recommended the Council to purchase the gas-works, subject to the consent of the Local Government Board. It is proposed that the price shall be determined by two valuers.

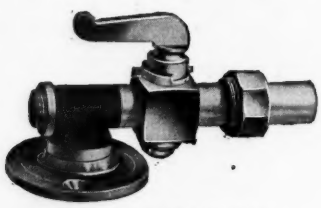
Fatal Mill Fire at Chorley.—The most disastrous fire of recent years at Chorley occurred on the evening of Sunday, the 19th inst., when the large Sovereign Mill belonging to the Chorley Cotton Spinning and Manufacturing Company was completely gutted; the fire raging from 3.30 p.m. until the early hours of Monday morning. It was stated in a local paper that it was while some workmen were engaged at one end of the spinning-room on the fifth floor in installing a high-pressure system of incandescent gas lighting that they observed smoke issuing from some material in another part of the room. Buckets of water were at once thrown on the burning material, but without effect. The mill was one of two which were being fitted with high-pressure gas; but as the installation was not complete, there is no evidence that the new system of lighting had anything at all to do with the fire. In reply to an inquiry, we learn from Mr. J. W. Allin, the Gas Engineer and Manager to the Chorley Corporation, that he had an interview on the subject of the fire with the representative of the firm who were putting in the high-pressure installation, and was assured by him that there was not, at the time the fire broke out, any gas, either high or low pressure, being used in the mill, except a few lights in the carding-room, which were supplied from a separate set of pipes to those on which the men were working. The men were in an upper room of the mill, and had not put the burners on to the pipes, but were preparing to do this, and to mantle them. The origin of the fire certainly does not seem to be connected with the installation of the high-pressure gas, and is a mystery.

Something New!

TWO-WAY GAS FIRE TAP.



USED AS STRAIGHT-WAY TAP.



USED AS ELBOW TAP.

The alteration is made by changing the position of screwed plug.

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Another Explosion through a Defective Cable.

The serious explosion and fire in the Strand last Thursday, as reported in another part of the "JOURNAL," were followed early on Sunday morning by an explosion which wrecked the Albert Hotel in the Derby Road, Nottingham. The first indication of trouble was noticed shortly after midnight by someone detecting the smell of burning bitumen, and concluding that a leakage from the electricity cable was the cause. He accordingly telephoned to the Fire Station and to the Electricity Department, and firemen and workmen were immediately sent down. Smoke was then found to be issuing from the pavement in front of the hotel. The proprietress was roused, and an endeavour was made to gain access to the seat of the trouble through the cellars of the hotel. The cable was laid between the pavement and the roof of the cellar; and there seemed to be no means of getting at it from this direction. Suddenly there was a terrifying flash—whether from the pavement, the cellar, or elsewhere it was impossible to determine—then the pavement in front of the hotel and half the roadway of the adjacent thoroughfare, Globe Street, were hurled bodily into the air, and with them a great part of the front portions of the hotel. Fortunately, the explosion was not followed by fire or attended by loss of life; but ten persons were injured, and seven of them had to be detained at the General Hospital. It was at first supposed that the fusing of the electric cable had ignited an escape of gas from one of the mains under the pavement. But the Chairman of the Gas Committee of the Corporation (Mr. Albert Ball) informed the representative of a local paper that the mains and pipes had been found to be intact, and that the gas service of the hotel could be used after the explosion.

Sales of Gas and Water Stocks and Shares.—At a recent sale at Grimsby, £3000 of new ordinary stock of the Cleethorpes Gas Company, carrying £7 7s. per cent. dividend, fetched from £157 to £160 per £100 of stock. At Grantham, on Monday last week, Messrs. Escritt and Barrell sold £200 of stock of the Grantham Water Company at 25s. 6d. per £1, and a like nominal amount at 25s. 9d. per £1. On the same occasion, £400 of stock of the Grantham Gas Company fetched 22s. 9d. per £1. At sales which took place last week, 32 £10 shares in the Torquay Gas Company, bearing a dividend of 10 per cent., fetched £21 10s. each; and 87 shares of like nominal value in the Paignton Gas Company realized from £20 5s. to £21 10s. per share.

The Patent Tube Covering and Lining Company, Limited, with a capital of £150,000, in £1 shares, has been formed to turn to account inventions relating to covering and lining tubes with lead, tin, &c.

The balance of revenue of the South-West Suburban Water Company for the past half year, including the amount brought forward, is £16,024; and, after adding £650 to the contingency fund and providing for interest on debenture stock, the Directors recommend a dividend at the rate of 7 per cent. per annum on the original shares, with a carry-forward of £7107.

The British Empire Lighting and Construction Company, Limited, has been registered with a capital of £5000, in £1 shares, to carry on the business of suppliers of gas and manufacturers of gas plant, &c.

It has been decided by the Chapel-en-le-Frith Rural District Council to apply for power to borrow £4000 for the construction of a reservoir; the apportionment of the cost to be as follows: Chapel, £1875; Wormhill, £2125.

The "Tunbridge Wells Advertiser" last Friday contained an effective advertisement headed: "What about the Lighting and Heating of your Home?" The value of gas as "the willing servant—the silent help" was set forth in letterpress enclosed by advertisements.

The lamplighters in the employ of the Rochdale Corporation Gas Department having complained that the re-arrangement under which holiday pay was added to wages left them 1s. 8d. a year worse off than they were before, the Gas Committee have now decided to pay the men a lump sum of 4s. 4d. at Christmas time.

We have received from Messrs. D. Hulett and Co., Limited, of High Holborn, their supplementary list No. 158. It presents for selection a large assortment of gas-fittings for indoor and outdoor use, lamps, and inverted burners; together with particulars of the "Fleet" and "Victor" geysers, grillers, radiators, &c., mantles, burners, and new patterns of upright and inverted globes.

The large catalogue of the gas department of the Brimsdown Lamp-Works, Limited, of Nottingham, of which a copy has been sent to us, contains an excellent collection of Pintsch inverted burners and outdoor lamps, Imperial ramie and new elastic mantles, chandeliers, and other lighting appliances and accessories. The Company were awarded a gold medal at the Nottingham Exhibition in June last.

At a recent meeting of the Cardiff Chamber of Trade, a discussion arose as to the price of gas; and a resolution was passed regretting that the Gas Company had not seen their way clear to give a "real" reduction in price, which "was at present higher than was charged in most other towns of similar size and population." It was determined to take further steps to bring pressure to bear on the Gas Company to make a more substantial reduction.

Last Thursday week, a lecture was given by Mr. N. H. Humphrys, the Engineer and Manager of the Salisbury Gas Company, to the members of the outdoor staff, on the subject of "Gas-Supply Pressure." Having stated that he was proud to belong to the gas industry for two reasons—first, because it was all English with no "Made in Germany" about it, employing English material and local labour; and, secondly, because it created a demand for a large number of workers—he proceeded to explain the correct meaning of the word "pressure" and the physical laws governing the matter, following this up with a demonstration by the aid of a model gasholder and set of burners representing an ordinary house installation. A discussion followed; and at the close a vote of thanks to the lecturer was carried with applause, on the motion of Mr. Bowering (outdoor foreman), seconded by Mr. Lucas (maintenance foreman).

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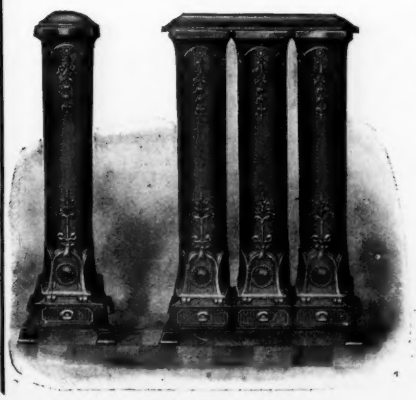

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Appointments Vacant.
GAS MANAGER. Quakers Yard Gas and Water Company. Applications by Nov. 30 to Dr. Leigh, Treharris.
CHEMICAL EXPERT (Coking and Bye-Products Plant). A. Gillespie and Son, Glasgow.
DRAUGHTSMAN. No. 7009, care of Willings.
GAS METER TESTER. Leicester Corporation. Applications by Dec. 14.
SHOW-ROOM ATTENDANT. No. 5484.
STOKER. Connah's Quay Gas Works.

Appointments Wanted.
CHEMICAL PLUMBER, &c. No. 5450.
TOWN AGENT, SALES MANAGER, SECRETARY, &c. No. 5485.

Patent Licence.
BOILER OR WATER HEATER. H. Haddon and Co., Bedford Street, W.C.

Stocks and Shares.
AYLESBURY GAS COMPANY. By Auction. Dec. 12.
EAST GRINSTEAD GAS AND WATER COMPANY. By Auction. Dec. 5.

Stocks and Shares *(continued)*—
NORTH MIDDLESEX GAS COMPANY. By Auction. Dec. 12.
SHREWSBURY GASLIGHT COMPANY. By Tenders. Dec. 16.
SOUTH KENT WATER COMPANY. By Auction. Dec. 12.
SOUTH-WEST SUBURBAN WATER COMPANY. By Auction. Dec. 5.
SOUTHEND WATER-WORKS COMPANY. By Auction. Dec. 5.

TENDERS FOR

Coal.
NOTTINGHAM CORPORATION. Tenders by Dec. 7.

Fire-Clay Goods.
LEICESTER GAS DEPARTMENT. Tenders by Dec. 9.

General Stores (Picks, Shovels, &c., Ironmongery, Cement, Lime, Bricks, Timber, Earthenware Pipes, Castings, Flags, Setts, Gravel, Brushes, Disinfectants, &c., &c.).
NOTTINGHAM CORPORATION. Tenders by Dec. 7.

Pipes, &c.
LEICESTER GAS DEPARTMENT. Tenders by Dec. 9.

Plumbing Work.
NOTTINGHAM CORPORATION. Tenders by Dec. 7.

Purifier Boxes.
SHEFFIELD UNITED GASLIGHT COMPANY. Tenders by Dec. 5.

Scrubbers and Washers.
SMETHWICK GAS DEPARTMENT. Tenders by Dec. 2.

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SHEFFIELD UNITED GASLIGHT COMPANY. Tenders by Dec. 5.

Tar (Refined) and Pitch.
NOTTINGHAM CORPORATION. Tenders by Dec. 7.

Tar and Liquor.
SHOTLEY BRIDGE AND CONSETT DISTRICT GAS COMPANY. Tenders by Dec. 6.

TAR PRODUCTS PRICES.

Representative manufacturers give the following as fair current values for the week ending Nov. 25. Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

Article.	Basis.	London.	North-East Coast.	East Coast, Yorks.	West Coast.		Glasgow.
					Liverpool.	Manchester.	
Tar, crude	per ton	—	20/6 26/-	22/- 26/-	—	21/- 25/-	—
Pitch	,,	42/6	40/3	40/6	40/-	39/3	40/-
Benzol, 90%	per gallon	1/2½	-/11½	-/11½	—	-/10½	-/11½
Benzol, 50-90%	,,	—	-/11¼	-/10½	-/10	-/10½	—
Toluol, 90%	,,	1/1	-/11¼	-/10½	-/10	-/10¼	-/11
Crude naphtha, 30%	,,	—	-/4½	-/4½	-/3½	-/4	—
Light oil, 50%	,,	—	-/3½	-/3¾	-/3½	-/3¾	—
Solvent naphtha, 90-160	,,	—	-/10¾	-/10	-/10	-/10¾	-/11½
Heavy naphtha, 90-190	,,	—	-/11½	-/11	-/11¼	-/11½	-/11½
Creosote in bulk	,,	-/3	-/2½	-/2 7/16	—	-/2½	-/2
Heavy oils	,,	—	-/2⅝	-/2½	-/2¾	-/2¾	-/2¾
Carbolic acid, 60's	,,	2/5	2/3	2/4	2/2	2/2	2/4
Naphthalene, crude drained salts	per ton	—	44/6	42/6	47/6	48/9	—
,, pressed	,,	—	61/6	63/-	60/-	60/- 75/-	—
,, whizzed	,,	—	—	—	70/- 72/6	65/- 75/-	62/6
Anthracene	per unit	-/1 7/8	-/1½	-/1½	-/1¼	-/1¼	—

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

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